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A Quantitative Analysis of the Effect of Integrated Co-Teaching on the Growth of English Language Arts and Mathematics Achievement in Elementary School Students Using Student Growth Percentiles

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Abstract

This causal-comparative study provides a descriptive analysis of the impact of participation in co-taught classrooms compared to traditional classrooms on the academic growth of students with and without disabilities. This issue is examined in English language arts and mathematics using the New York State testing program results. A quasi-experimental design and a post hoc statistical analyses using t-tests was used to look for statistical differences between identified groups. Achievement growth was operationalized as the student growth percentile on the NYS New York State assessments, and group means were compared by grade level over five years. The findings from this study suggest that achievement in English language arts and mathematics for all students in integrated co-taught classrooms is likely to be comparable to, or better than, that for students in traditional classrooms. Further, participation in a co-taught classroom is unlikely to impact nonidentified peers negatively and may benefit them, particularly in mathematics. Additionally, students with disabilities may benefit slightly more from a co-taught setting than their peers not identified with disabilities. Considerations for policy makers and administration are discussed as well as recommendations for further research.

A Quantitative Analysis of the Effect of Integrated Co-Teaching on the Growth of English Language Arts and Mathematics Achievement in Elementary School Students Using Student Growth Percentiles

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Chapter I

Introduction

During the summer of 1984, I took a summer job as a paraprofessional at a newly opened residential facility in the Catskill mountains for children with significant disabilities that was, I suppose, cutting edge for its time. I was young, naive and eager to save the world. My first efforts at changing the world began with feeding and changing the diapers of children who had been institutionalized by their parents. These children had minimal schooling, contact with their families or access to the world. It was there that I met Lizzy and Eddie and had my first exposure to children with autism. Their faces will be forever in my memories as their intelligence and unmet potential burned in their eyes. I was given a glimpse into the lives of children whom society did not view as competent and worthy of inclusion, as well as the danger of low expectations. Over the past 33 years I have not succeeded in saving the world, but I have made tiny steps toward creating inclusive educational spaces for children. Thankfully, much has changed in public education when it comes to educating students with disabilities. It is our collective responsibility to find socially just and responsive educational settings that meet the academic needs of all learners including those like Lizzie and Eddie. Co-teaching may be an effective means to meet this charge, and this is why I have chosen this area of research.

In the United States, public schools are being held accountable for increased academic achievement for students with disabilities. Federal legislative acts including the Elementary and Secondary Education Act (ESEA), also known as the Every Student Succeeds Act (ESSA, 2015), and the Individuals with Disabilities in Education Act (IDEA, 2004) drive States to create regulations that improve student achievement outcomes for students with disabilities in the least

restrictive educational environment. This setting is often in the general education classroom with their peers. As public school districts are being held accountable for adequate yearly progress in academic achievement for students with disabilities, it has become increasingly important that special education practices are evidenced-based and shown to be effective.

This study examines co-teaching as an inclusive educational practice and its impact on student achievement in English language arts and mathematics using a metric for assessing academic growth rather than proficiency. The reasons for co-teaching, including social-emotional benefits, social justice, and accountability, are explored followed by a personal statement describing this researcher's background in special education and interest in co-teaching. A background statement situates the study in a political context, the problem statement identifies the reasons why further research on this topic is important and warranted and, finally, why the problem is important is discussed in detail.

Background Statement

Increasingly, students with special education needs are being educated in inclusive general education settings rather than in self-contained classes or special schools. Conflicting views exist in the literature regarding where their education should take place, what that education should consist of, and how that special education should be delivered (Giangreco, 2015; Zigmond, Kloo & Volonino, 2010). Critics worry about the effects of inclusion on both students with disabilities and their peers who have not been identified as having an educational disability (Murawski, 2001; Scruggs, 2007).

The literature is rich with studies examining the benefits of inclusion on social-emotional development and feeling acceptance in the classroom environment (Agbena, 2017; Avramidis, 2010; Frattura & Caper, 2006; Gray, Wilcox, and Harris, 2017; Osterman, 2000; Rose &

Shevlin, 2017; Schmidt & Cagran, 2006; Schwab, 2015; Strogilos, Tragoulia, & Kaila, 2015; Shogren, Gross, Forber-Pratt, Francis, Satter, Blue-Banning, & Hill, 2015). Quality belonging, defined as membership in a community with equal access to resources, is a prerequisite to well-being. Inclusive researchers are increasingly advocating for educational spaces where every child will experience quality belonging. Educators need to make curriculum decisions that uphold all students' rights to have their cultures, identities, abilities, and strengths acknowledged (Agbena, 2017). Inclusive classrooms benefit the social-emotional development of all students as Schwab (2015) found that students without special education needs had higher scores on friendship and peer acceptance when they were in an inclusive class.

Social justice is also a driving force behind many school leaders supporting inclusive practices such as co-teaching (Frattura & Caper, 2006; Theoharis, 2007).

> All students should have the opportunity to attend their neighborhood school (or preferred school in school choice systems) and be placed in heterogeneous classrooms at their grade level alongside their peers. This placement is the least restrictive, least intrusive, and least disruptive in their daily lives; encourages independence in learning and not being over-helped (i.e., it is the least enabling); and ultimately is the least expensive (Frattura & Caper, 2006, p. 23).

Inclusive education may be ideally suited to address social justice for marginalized student populations. And co-teaching may be an effective methodology for creating inclusive educational settings.

> Nowadays, inclusive education is increasingly considered to be the provision of high-quality, friendly, and diverse learning environments for all; it is no longer solely understood as the sum of initiatives and efforts in favour of specific groups or targeted categories. An inclusive education system at all levels is not one which responds separately to the needs of certain categories of learners but rather one which responds to the diverse, specific, and unique characteristics of each learner, especially those at risk of marginalization and underachievement under common frameworks of settings and provisions. Respect for cultural, local, and individual diversity is a core concept in the process of inclusive schooling, which requires shared agreement amongst diverse groups around the basic organization and functioning of a given society and culture (Opertti & Brady, 2011, p. 460).

School leaders, including district and building administrators and teacher leaders, must support the movement toward inclusion in education for human rights and social justice purposes as well as for the need for schools to demonstrate a positive impact on students' academic growth. Effective leaders increase the capacity of adults to imagine what could be achieved and increase their sense of responsibility for bringing about an inclusive atmosphere (Ainscow & Sandill, 2010). The importance of effective leadership in creating inclusive educational environments has been firmly established in the literature (Conderman & Hedin, 2015; DeMatthews & Mawwhinney, 2014; Hazel & Allen, 2013; Hoppey & McLesky, 2013; Lewis, 2016; Loreman, 2014; Miskolci, Armstrong & Spandagou, 2016; Lyons, Thompson, & Timmons, 2016; Morningstar, Shogren, Lee & Born, 2015; Pazey & Cole, 2012; Theoharis & Causton, 2014; Toson, Burrello, & Knollman, 2013).

In order to create a shared vision, leaders must have knowledge and passion around the ideals of social justice. Theoharis (2007) examined the many definitions of social justice leadership and defined it as leaders who "make issues of race, class, gender, disability, sexual orientation, and other historically and currently marginalizing conditions in the United States central to their advocacy, leadership, practice, and vision" (Theoharis, 2007, p. 223). Capper and Young (2014) assert that leaders must understand the power of inclusion and frame, fund, and implement new learning environments. They must make increased student learning their primary goal and become experts on the range of student differences. Socially just schools must be understood to be the responsibility of a principal along with leadership teams and community members. "The field needs more examples of how leaders work with their colleagues and communities to collaboratively build inclusive communities and hold one another responsible for strong student and community outcomes" (Capper & Young, 2014, p. 163).

The background and context of this study are important as perhaps never before in the history of public education has the pressure to improve student achievement been so great (Amrein-Beardsley, 2014). Federal legislation requires districts to demonstrate adequate yearly progress in student proficiency in English Language Arts and mathematics using standardized tests for students in grades three through eight (ESSA, 2015). Sanctions are imposed on states, districts, and schools that do not demonstrate formula driven rates of student proficiency, especially for targeted subgroups including students with disabilities. The government has identified many districts in New York State as failing to demonstrate adequate student progress for students with disabilities on the NYS English language arts and Math exams (NYSED Website Accountability Determinations, 2019).

As districts scramble to meet legislative mandates, instructional practices are being implemented at a rapid rate. Often changes are made before there is a solid research base supporting them as effective for improving student achievement (Weiss, 2004). Districts may also fail to make change despite unsatisfactory results from current practices (Capper & Young, 2014).

At the same time that there is a tremendous drive to improve student scores on state assessments, there is an increasing push to provide inclusive environments for students with disabilities that allow access to the same general curriculum provided to their peers. In order to ensure compliance with the Individuals with Disabilities in Education Act (IDEA, 2004), districts are making changes in instructional models so that students can be educated in the least restrictive environment, which is often the general education classroom. Accountability requirements have increased the number of inclusive educational environments in schools (Weiss, 2004).

Concurrently, there have been recent changes in the way New York State reports student proficiency. In the past, proficiency cut scores were used to determine levels of achievement in grades 3-8 and districts were held accountable to ensure that an appropriate number of students met prescribed proficiency levels. The State identified scaled scores that indicated academic proficiency on state assessments and compared the percentages of students obtaining a defined proficiency level at each grade level compared to the year before. The flaw in this model was that different grade level cohorts were compared and growth within individual students was not measured (Bettebenner, 2009).

A new growth model being implemented by New York State uses student growth percentiles (SGP) to compare students' performance on the state tests to the average growth across the state demonstrated by similar students with the same starting point. As part of the new Annual Professional Performance Review process, New York State teachers of math and English Language Arts in grades 4 through 8 received State-provided growth scores based on the New York State testing program in English language arts and mathematics. These growth scores were designed to describe how much students in their classrooms and schools grew each year academically in those subjects (as measured by the New York State tests) compared to similar students (Growth Reporting System Guide NYSED, 2012). The student growth percentile is a comparison of how each student performed in comparison to similar students who obtained the same score on the previous year's test.

The average student growth percentile scores for programs or mean student growth percentile can be an effective way to assess relative group changes in students' English language arts and math achievement (Amrein-Beardsley, 2014; Bettebenner, 2009). Demographic data such as poverty and disability are included in the calculations and allow for a variety of

comparisons between subgroups. This data has not been readily available for analysis in the past, but is emerging as a way to describe the impact of programs on student achievement growth (Bettebenner, 2011).

Problem Statement

Co-teaching is increasingly emerging as a service delivery model for students with disabilities (Solis, 2012; Weiss, 2004) as a means for creating inclusive educational settings. Research regarding the impact of co-teaching on the academic achievement of students with and without disabilities has been somewhat ambiguous due to the challenges of assessing educational achievement longitudinally (Friend & Hurley-Chamberlain, 2011; Hang & Rabren, 2009, Piechura-Couture, Tichener, Touchton, Macisaac & Heins, 2006; Volino, 2007; Weichel, Murawski, 2001).

Co-teaching is a specific inclusive instructional model that districts are implementing across the country as a method to educate students with disabilities in general education settings, and there is a great deal of descriptive research on co-teaching (Friend, 2011). However, a variety of qualitative and quantitative studies have examined the effects of co-teaching with little conclusive quantitative evidence that it is an effective approach for improving achievement for students with disabilities, particularly in the area of literacy (Friend, 2011, Murawski, 2001, Scruggs, 2007). Critics worry about the effects of co-teaching on both students with disabilities and students not identified as having an educational disability (Dessemontet, Bless, Farrell, Dyson, Polat, Hutcheson & Gallannaugh, 2007; Ghandi, 2007; Kalambouka, 2007; Robinson & Babo, 2014; McDonnell, Thiorson, Discher, Mathot-Buckner, Mendel & Ray, 2003).

Under this political context, many factors contribute to the effectiveness of co-teaching. Nichols, Dowdy, Nichols and Vista (2010) found that the co-teaching models in the schools they

surveyed were, for the most part, initiated without proper staff development for regular education teachers, special education teachers, and educational leaders, and this would suggest that co-teaching is was being initiated primarily for compliance with federal legislation and less for quality instruction for students with disabilities and their non-disabled peers. As a response to ESSA's (2015) accountability requirements, States have been implementing growth models such as student growth percentiles as a means to evaluate effective teachers (Amrein-Beardsley, 2014; Bettebenner, 2011) rather than as a means to evaluate effective instructional practices.

This study will explore the following questions; (1) Is there a difference in the average academic growth in English language arts and mathematics for all students in grades four through six who attended integrated co-taught classrooms compared to all students who attended traditional classrooms? (2) Is there is a significant difference between the average student achievement growth in English language arts and mathematics for all students not identified with an educational disability in grades four through six who attended integrated co-taught classrooms class compared to all students not identified with an educational disability who attended traditional classrooms? (3) Is there is a difference in the average English Language Arts (ELA) and math achievement growth for students with disabilities in integrated co-taught classrooms compared to students with disabilities in all other special education settings? Finally, (4) is there is a difference in the average English language arts and mathematics achievement growth between students with disabilities compared to students not identified disabilities within integrated co-taught classrooms?

Why the Problem is Important

It is critical to study the effects of the co-taught classroom on students' academic achievement so that educators can make informed decisions on how best to educate students with

disabilities to optimize student outcomes, as well as understand the impact of the integrated co-taught classroom on students without disabilities.

In New York State co-teaching called integrated co-teaching (ICT) and is an optional special education program. Because schools today must quickly implement effective instructional practices that are inclusive and result in academic growth, it is imperative that co-teaching be evaluated by administrators in terms of its effect on student achievement. Strategies that improve English language arts and mathematics are likely to result in improved student educational outcomes. For this reason, researchers must evaluate co-teaching in terms of its effect on English language arts and mathematics academic growth. Information from this study will be necessary for districts so that administration can make informed decisions, based on quantitative data, regarding programming for students with disabilities. This is important work because if districts choose to implement co-teaching, officials must be able to predict the likely impact on English language arts and mathematics achievement for all students. Additionally, the call for higher academic standards and achievement for all students and education in the least restrictive environment for students with disabilities may increase the use of co-teaching as a socially just, instructional practice if it is found to have a positive impact on student achievement as well as social-emotional development. (Farrell, Dyson, Polat, Hutcheson, & Gallannaugh, 2007; Fontana, 2005; Huberman, Navo, & Parrish, 2012; Salend & Garrick Duhaney, 1999; Tremblay, 2013; Walsh, 2012). Therefore, it is imperative that the effects of including students with disabilities in the regular education setting be continually evaluated and assessed so that the experience can be optimized and possible adverse effects can be addressed by educators proactively.

Chapter II

Literature Overview

In this chapter, co-teaching will be defined as it is viewed in the literature and described as a special education service as it implemented per New York State regulations. Reasons for the increase in the use of this service delivery model will be discussed. Challenges in evaluating co-teaching will be discussed as well as current findings regarding the impact of co-teaching on students with and without disabilities. The need for further research will be explained. Next, a description of student growth percentiles will be presented as well as how they are defined and calculated in New York State. Finally, there will be an overview of how student growth percentiles may be used to describe growth in student achievement.

Definition of Co-teaching

Co-teaching is a service delivery model for providing an inclusive environment for educating all students that has been studied extensively. "Over the past 20 years, a convergence of legislative pressures has challenged educators to find efficient yet effective ways to provide high-quality instruction for students with disabilities" (Solis, 2012, p. 498). Researchers have begun to explore co-teaching as an effective instructional model that promotes inclusion (Farrell, Dyson, Polat, Hutcheson, & Gallannaugh, 2007; Fontana, 2005; Huberman, Navo & Parrish, 2012; Salend & Garrick Duhaney, 1999; Tremblay, 2013; Walsh, 2012).

Co-teaching is often described as collaboration, teaming, team teaching and inclusion. Friend and Hurley-Chamberlain (2011) provide the four essential characteristics of co-teaching; (1) students with disabilities receiving their specialized instruction in the context of the general education classroom, (2) two or more professionals with equal status are the co-teachers, (3) the general education teacher is primarily responsible for the content of the instruction and the

special education teacher is responsible for the learning process, and finally, (4) students are heterogeneously grouped and both teachers work with all students. An overarching assumption, according to Friend and Hurley-Chamberlain (2011) is that the instruction provided is evidenced-based and teachers are accountable for differentiation.

Carty and Farrell (2018) describe the most commonly used models of co-teaching. They are: one teach, one assist or observe, parallel teaching (each teacher teaches half the class), alternative teaching (one teacher leads a large group while one teacher works with a small group), teaming (teachers work together to provide instruction to the whole group) and station teaching (teachers divide content and teach to small groups). Each method is described as having benefits and challenges.

Districts are implementing integrated co-taught services as an instructional model that educates students with disabilities in inclusive settings in New York State. It is defined in the regulations as the provision of specially designed instruction and academic instruction provided to a group of students with and without disabilities. The maximum number of students with disabilities receiving integrated co-teaching services in a class is determined in accordance with the students' individual needs as recommended on their individualized education plans (IEPs), provided that the number of students with disabilities in co-taught classes does not exceed 12 students or 50% of the students in the classroom. It is important to note that the regulations do not specify the use of a particular co-teaching model.

In response to ESEA and IDEA, in April 2008, the New York State Education Department (NYSED) issued a memo supporting research-based special education instructional practices and services provided to students with disabilities (SWD) in general education classrooms with their non-disabled peers to the maximum extent possible. Changes were made to

the continuum of services offered that already included related services, resource room support, consultant teacher services, and segregated special classes. The Board of Regents approved amendments to the Regulations of the Commissioner of Education and integrated co-teaching (ICT) was added as an optional special education program for districts (Delorenzo, 2008). Integrated co-teaching is defined in Part 200 of the NYSED Commissioner's Regulations, as a certified general education teacher and special education providing direct instruction to all students regardless of disability. The regulations do not specify required periods of time during the day or which co-teaching models must be used. This model is the states response to creating more inclusive educational environments.

Accountability and the its impact on co-teaching

Co-teaching is a methodology that has seen as a significant increase in school districts. This change may be the result of increased accountability for school districts to increase achievement for students with disabilities (Harr-Robins, Song, Garet, & Danielson, 2015, Weis, 2004). There is a push for co-teaching in contemporary schools. According to Weiss (2004), special education teachers increasingly are being asked to co-teach with general education teachers to meet the needs of students with disabilities. Solis, Vaugh, Swanson, and McCulley (2012) state that over the last few decades resource rooms have been increasingly replaced with inclusive models that rely heavily on co-teaching and coordination between general and special education.

A municipality in Sweden represents an example of how increased accountability can result in a move toward inclusion as a means to address the academic success of all students. As a result of data indicating the need to improve student achievement, a municipality in Sweden adopted inclusive practices with what has been described as exceptional success (Persson, 2013).

Persson (2013) found that the starting point for the municipality's significant increase in student achievement was a change toward inclusive schooling. Ability grouping and special education grouping were eliminated, and all students were given the opportunity to participate and succeed in regular education classes with their peers. The municipality developed a model in which two teachers were assigned to each classroom. Although Persson (2013) could not conclude that the improvements in academic results were directly related to the move toward inclusion, it was clearly a driving force behind the research, curriculum and teaching methods used in the school. Persson stated, "The informants do not problematize the concept of inclusion, either ideologically or politically. The concept was established firmly in the literature studied, but with a clear reference to the perceived functioning in practical activities. At the same time, it is obvious that they have established a thought style in which inclusion is a guiding principle for teaching and learning, but where the wider aim is a more inclusive society" (Perssons, 2013, p. 1217). This study concluded that focusing on inclusion as a means to obtain instructional practices changed the traditional thought of the school and likely lead to higher academic achievement.

School districts have had to rapidly adapt instructional practices to better address the academic needs of students with disabilities (Harr-Robins, Song, Garet, & Danielson, 2015). Harr-Robins, et al. (2015) studied the impact of school accountability for students with disabilities on instructional practices. The study hypothesized that increased accountability for students with disabilities would result in schools adopting and implementing different school and instructional practices with the goal of improving achievement outcomes for students with disabilities. They found that significantly greater numbers of students moved from self-contained, segregated classes to regular education classes and a higher percentage of students

were educated in co-taught classrooms than in pull-out resource rooms. Therefore, they found that when schools were "held accountable" or sanctioned for failing to increase achievement for students with disabilities, instructional practices resulted in greater integration in the general education setting through co-teaching.

States have responded to the need to include students with disabilities in general education settings. For example, in response to ESEA and IDEA, in April 2008, the New York State Education Department (NYSED) issued a memo to districts stressing the need to support research-based instructional practices and provide special education services to students with disabilities to the maximum extent possible in classrooms with their non-disabled peers. Integrated co-teaching (ICT) was added as an optional special education program for districts in New York State (Delorenzo, 2008).

The research challenges in evaluating co-teaching

There are many challenges in evaluating the effectiveness of co-teaching. Piechura-Couture, Tichener, Touchton, Macisaac, & Heins (2006) acknowledge that few studies have examined the effectiveness of co-teaching and discuss why this may be. They state, "Part of the problem stems from a lack of understanding and agreement about the term co-teaching. Co-Teaching has many names and is often referred to as team teaching, cooperative teaching, or collaborative teaching" (Piechura et al., 2006, p. 39). This complexity is found throughout the literature as the definition of co-teaching evolves (Volino & Zigmond, 2007; Weichel & Murawski, 2001).

Others have explored the challenges of studying co-teaching. Weichel and Murawski (2001) describes six limitations in research on co-teaching which include; (1) leaving out vital information on measures employed; (2) interviewing co-teachers already considered successful;

(3) success or failure dependent on teacher personalities; (4) different definitions of co-teaching; (5) qualitative rather than quantitative studies; and, (6) few studies that include the actions of the special education teacher during the process of co-teaching. "Including students with disabilities into general education has been the subject of intense debate and much research" (Volonino & Zigmond, 2007, p.293). Volonino and Zigmon (2007) reference past research suggesting that results from programs that use special education teachers in consulting or co-teaching roles have been conflicting and unequivocal. They conclude that the practices in co-taught classes often vary from the theoretical models and therefore it is difficult to study the effectiveness of co-teaching models. It is suggested that the effectiveness of co-teaching be explored through carefully designed experimental studies.

The impact of co-teaching on students

Earlier research on the educational benefits of the inclusion of students with disabilities into the general education setting found mixed results. Salend and Duhaney (1999) reviewed the literature concerning inclusion and found that the impact of inclusion programs on the academic and social development of students with disabilities has been mixed. They found that inclusion did not appear to interfere with the academic performance of students without disabilities and may have some social benefits. They determined that although the inclusion movement had the potential to have a positive impact on students with and without disabilities and their teachers, it had not been consistently proven in research (Salend & Duhaney, 1999). Therefore, they conclude that researchers and school districts need to work together to validate and disseminate information regarding effective inclusions practices, policies, and programs.

Other studies have found that inclusion results in improvements in other areas such as adaptive, academic, behavioral and vocational competence functioning for students with

disabilities who were included in general education but not necessarily in a co-taught classroom. McDonnell, Thiorson, Disher, Mathot-Buckner, Mendel, and Ray (2003) conducted an exploratory study to evaluate the impact of inclusive educational programs on the achievement of students with developmental disabilities and their peers without disabilities. The results found improvements in adaptive behavior for students with developmental disabilities. However, the results of a one-way Analysis of Variance indicated no significant differences in the academic performance in reading /language arts and mathematics of students without disabilities enrolled in inclusive classes and those who were not. However, Curcic (2012) also investigated concerns with student outcomes in inclusive settings. "A number of studies showed positive correlation between students' placement in inclusive settings and their school outcomes. The placement was positively correlated with increased academic and vocational competence, performance on state-level tests, and graduation rates, although not necessarily with students' psychosocial development (Curcic, 2012. p. 12)."

The benefits of co-teaching for students with disabilities have more recently been established by research (Curcic, 2012; Garderen, Stormont, & Goel, 2012; Hang & Rabren, 2009; McDonnell, Thiorson, Disher, Mathot-Buckner, Mendel, & Ray, 2002, Solis, Vaughn, Swanson, & McCulley, 2012; Walsh, 2012).

> Twenty years have passed since co-teaching was introduced as a more beneficial alternative to providing service to students with disabilities through shared responsibility of general and special education teachers. Although there are continued calls for more efficacy research regarding co-teaching, quantitative and qualitative research over the past 20 years has consistently determined that students in co-taught classrooms learn more and perform better on academic assessments than do students in more restrictive service delivery models. (Walsh, 2012, p.32).

Walsh (2012) found that co-teaching in the context of effective system-wide professional development, school-based coaching and administrative support resulted in increased

performance in reading and math for students with disabilities. In a much more in-depth review of co-teaching, Further, Solis, Vaughn, Swanson, and McCulley (2012) synthesized 146 studies on co-teaching. They asked,

> What evidence is there that this model, although prevalent, is more effective than other models? Recognizing that fewer than 15% of the 146 studies included in these syntheses provided data on student outcomes, and very few studies systematically manipulated the influence of co-teaching on students with and without disabilities, the most promising interpretation of the data is that co-teaching is likely to be associated with small gains when implemented appropriately. (Solis et al., 2012, p. 507).

They also found that teacher's attitudes toward students with disabilities improved with inclusion.

In order to determine the impact that collaboration (including co-teaching, consultation, collaborative teaming, and cooperative teaming) has on academic, social and behavioral outcomes for students with disabilities, (Garderen, Stormont, & Goel, 2012) conducted a literature review and found that, generally, the studies found improved outcomes for students. However, the findings were declared tentative given the small number of studies identified, the variety of research methods used, and the variability in collaborative models.

Hang and Rabren (2009) found significant positive differences in student academic and behavioral performances when comparisons were made between the year before co-teaching and the year of co-teaching. The data sources for their study included observations, surveys, and records analysis and observations were used to determine the fidelity of treatment according to co-teaching components observed. A survey was administered to provide information on the perspectives of co-teachers and their students with disabilities and students' SAT scores, discipline records, and attendance records were analyzed to determine the efficacy of co-teaching. They concluded that co-teaching appears to be an effective instructional delivery model for meeting the needs of students with disabilities in general education classrooms.

Effects on students not identified as having an educational disability

There has been considerable interest in studying the effect of co-teaching or inclusion on the students not identified with a disability in the classrooms. Most studies found no adverse impact. (Dessemontet & Bless, 2013; Ghandi, 2007; Kalambuka, Farrell, Dyson & Kaplan (2007; McDonnell, Thiorson, Disher, Mathot-Buckner, Mendel, & Ray, 2003; McDonnell et al., 2003; Ruijs, 2017; Szumski, Smorgorzewski, & Karwowski, 2017). The placement of students with developmental disabilities in general education classes did not impact the achievement of their peers without disabilities on state-mandated tests in reading/language arts and mathematics (McDonnell et al., 2003). In 2003, McDonnell et al. conducted an exploratory study to evaluate the impact of inclusive educational programs on the achievement of students with developmental disabilities and their peers without disabilities. The results found no academic impact on the reading and math achievement of students without disabilities. Further, Ghandi (2007) conducted a study of the relationship between inclusion related variables and reading achievement of students without disabilities using a national dataset. The study concluded, "Findings from this study might alleviate, and place in context, concerns about possible negative impacts on the academic achievement of non-disabled students in general education classrooms that include students with disabilities" (Gandhi, 2007, p. 91). Ghandi further concludes that quantitative research methods are insufficient for truly understanding the effects and dynamics of inclusion and suggests future mixed methods studies that examine how inclusion leads to effects and how contextual characteristics may mediate effects.

Later, Kalambuka, Farrell, Dyson, and Kaplan (2007) conducted a systematic review of the literature to determine if the placement of students with special needs in the mainstream has an academic or social impact on peers without disabilities. They conclude that overall, this practice

has no adverse effects on students without special education needs. Dessemontet and Bless (2013) conducted a quasi-experimental study to determine if the inclusion of students with intellectual disabilities would affect the achievement of their peers without disabilities. They found that there was no significant difference between the academic achievement of non-identified peers when they were in an integrated a classroom with students with intellectual disabilities compared to their non-identified peers in classrooms not similarly integrated.

Most recently, Ruijs (2017) studied the effects of students with disabilities in regular schools on the academic achievement of their classmates. She examined this question in the context of primary and secondary education in the Netherlands using three independent identification approaches: student fixed effects models, school fixed effects models, and neighborhood variation. For both education levels and all three identification approaches, the estimates indicate that special needs students do not have a statistically significant effect on the academic achievement of their classmates. The estimates were precise enough to rule out even modest effects.

At least one study found a benefit for students without disabilities. Szumski, Smorgorzewski, and Karwowski (2017) presented a meta-analysis to establish how the presence of students with special needs in the classroom impacts students without special needs. They found that inclusive education may be beneficial for students without special education needs even when exploring the potentially moderating effects of the country of the study, the manner of implementation, the educational team composition, the level and type of disorders in students with special education needs and the educational stage of the students.

Conversely, in a study of the influence of inclusion on annual state assessments in reading and math for nondisabled students, Robinson and Babo (2014) found negative influences on the

students without disabilities in co-taught classrooms. This study examined the influence of student demographic variables and the school variable of placement in an inclusion setting on the academic achievement of general education students in grades six through eight in an urban school district as measured by the state's annual standardized performance assessment. Analyses were conducted using hierarchical multiple regression models with results suggesting that placement in an inclusion classroom did have a statistically negative significant impact on the scores of non-disabled students in one of the two schools, implying a variation of implementation at the school level. These results suggest that there are school-level factors at work in determining attainment and achievement in schools with similar levels of inclusivity. They suggest that likely school-level factors work to affect the achievement of students without disabilities in inclusive environments. The findings indicate that further research is needed to determine why inclusion might negatively impact the academic achievement of non-disabled students.

Need for Further Research

A variety of qualitative and quantitative studies have examined the effects of co-teaching with little conclusive evidence that it is an effective approach for improving achievement for students with disabilities (Friend, 2011). However, while there are many reasons for integrating students with disabilities in the general education setting, there is little empirical evidence that co-taught classes result in improved academic growth (Frattura & Caper, 2006). Volino and Zimond (2007) state, “In summary, although co-teaching may hold future educational promise for some students, in some classrooms, at present, the research base does not provide sufficient support to suggest it be either considered or implemented as a best practice” (Volino & Zigmond,

2007 p.298). Again, Volino (2007) reinforces the complexity and importance of studying co-teaching as an instructional methodology.

Through an analysis of research on co-teaching, Weiss (2004) claims that co-teaching may be an example of how advocacy for a practice can outpace the science that supports it. Weiss states that science has not answered the question of whether co-teaching is an effective use of resources in the instruction of students with learning disabilities. "It could be said that the acceptability of co-teaching is outpacing its effectiveness in delivering appropriate instruction" (Weiss, 2004, p. 219). Weiss (2004) concludes that co-teaching holds great potential for meeting the needs of students with learning disabilities; however, it may also serve as an example for how redefining the relationship between research and practice can improve instruction by using experimentation, problem-solving and data to drive future decisions. Weiss calls for further research citing that little research has described what is happening instructionally in co-taught classrooms and even less information is available about student outcomes in co-taught classrooms compared to other types of instruction.

Marilyn Friend (2011) states in her article titled, "*Is Co-teaching Effective,*" that we lack evidence on the effectiveness of co-teaching.

> Practice should be guided by data that indicates what works and what does not. For co-teaching, this roadmap for practice still is not clear. Much of what has been written about co-teaching consists of explanations for it and advice on how to create and sustain co-teaching programs. Such information is valuable, but it is just a beginning and it is not evidence of effectiveness. Studies of co-teaching have, in large part, focused on the perceptions of teachers and students. These studies generally find that students have a positive response to co-teaching. Teachers' responses are somewhat more complex. They recognize the value of classroom partnerships, but they express concern about its appropriateness for some students, its feasibility given pressures for high stakes testing and other accountability measures, and its practicality given current funding and staffing patterns for special education. (Friend, 2011, p.2)

Friend (2011) goes on to conclude that the missing piece in co-teaching concerns academic

and other outcomes for students and that local school districts are using their own measures to demonstrate that students' achievement and behavior in co-taught classes improve. Friend (2011) calls for more formal research that directly addresses these critical issues. She asks, "Do students with disabilities achieve at the same or a higher rate in co-taught than other service options? What is the impact of co-teaching on other students?" (Friend, 2011, p. 2).

Researchers have sought to validate co-teaching as an effective instructional model. After completing a meta-analysis of co-teaching, Weichel & Murawski (2001) conclude, “For co-teaching to be considered a valid service delivery option for students with disabilities in the general education or least restrictive placement, more experimental research must be conducted.” The complexity of evaluating the effectiveness of co-teaching is evident in the literature. Co-teaching is not clearly defined, instructional practices and curriculum in education vary greatly, and measuring achievement in diverse populations is complex. Researchers have found mixed results when studying the impact of co-teaching on students. It is critical that future laws and regulations drive practices that are proven through research to be effective. For this reason, it is essential that the effect of co-teaching on student achievement continues to be studied.

Using Student Growth Percentiles to assess academic growth

In the United States, interest in using growth models to improve the quality of school accountability systems has spurred the development of methods to assess students’ growth in academic achievement. In 2009, the U. S. Federal Office of Elementary and Secondary Education released a guidance document encouraging states to develop growth models that could track individual student achievement from one year to the next and give teachers, schools, and districts credit for improving student achievement over time. States were encouraged to submit high quality and innovative growth model proposals that would measure adequate student

progress over time (No Child Left Behind, 2009). Policymakers of school accountability were tasked with making decisions about how to develop and implement growth models in statewide accountability systems (Amrein-Beardsley, 2014; Clauser, 2016, Floden, 2015, Growth Models ESSA 2009).

The status measures being used by states, which measured achievement at a single point in time for accountability, were found to be ineffective for making judgments about educational effectiveness (Betebenner, 2009; Raudenbush, 2015). According to Betebenner (2009), the accountability systems being used by states to measure federal adequate yearly progress requirements relied upon annual “snap-shots” of student achievement to make judgments about school quality that did not accurately depict student learning for accountability purposes. “Most of the indicators used in the past to determine teacher quality have been found to be inadequate, particularly when used in isolation, in differentiating between teachers whose students perform well and those whose students are not making adequate progress” (Goe, 2011, p.2).

Instead, Raudenbush (2015) concluded that schools or teachers should be compared by their "value added" to student learning rather than by comparing the percent of students in a school or class who are classified as "proficient" as the differences in populations and the mobility of students across schools could result in measures that may not truly assess instructional effectiveness.

“Growth scores measure the change in student learning between two points in time and are not just a single snapshot of achievement. While educators cannot control the characteristics of students who enter their schools and classrooms, they can influence the learning that happens over the course of the year. This is what growth scores measure” (Tangorra & Commissioner, 2014). Measuring academic growth, rather than proficiency, allows for identifying strengths and

gaps in student progress and can help teachers support students who have a wide range of academic needs (A Principal's Guide to Interpreting State-Provided Growth Scores, 2013).

Growth models were developed by states that could also contribute to accountability mandates. Goe and Holdheide (2011) found that many states positioned themselves for a successful Race to the Top bid by passing legislation mandating that student achievement growth models be included as part of teacher evaluation. These growth models needed to include acceptable measures for determining teachers' contributions to student learning that were rigorous, between two points in time, and comparable across classrooms. However, according to Goe and Holdheide (2011), these terms were not explicitly defined in Race to the Top guidance as the federal government declined to offer definitions for these terms, preferring instead to encourage states to define them locally. Consequently, states began experimenting with a variety of strategies to move forward with Annual Professional Performance Reviews.

Student Growth Percentiles (SGP) were developed by Betebenner (2009) as a normative comparison of student growth that situates achievement change in terms of relative change compared to other students instead of the magnitude of change. "The current policy environment's adherence to high stakes accountability vis-a-vis No Child Left Behind (NCLB)'s universal proficiency mandate has fostered an impoverished view of what an examination of student growth can provide. To address this, student growth percentiles are introduced supplying a normative description of growth capable of accommodating criterion-referenced aims like those embedded within NCLB and, more importantly, extending possibilities for descriptive data use beyond the current high stakes paradigm" (Bettenbenner, 2009 p.45).

Student growth percentiles, according to Betebenner (2009), direct attention toward the relative standing of the student. Students enter teachers' classrooms at differing levels of

proficiency or academic achievement. Student growth percentiles belong to a “student growth” methodology with a focus on how much a student has improved or grown from one year to the next as compared to his or her academic peers, who had similar starting scores or performances. Student growth percentiles are relative measures, which focus on the rate of change in comparison to a student’s academic peers. The rate of the change is expressed using “percentiles” that can range from the first to the 99th percentile. Lower numbers indicate lower growth/change when compared to the peers, and higher numbers show higher change/growth. (Zhu, Boiarskaia, & Zhu, 2014).

A student's growth percentile describes how typical a student's growth on state assessments is by comparing his/her current achievement relative to his/her academic peers defined as those students beginning at the same place. A student's growth percentile examines the current achievement of a student relative to other students who have performed similarly in the past. Betebenner (2009) claims that student growth percentiles normatively situate achievement change; therefore bypassing questions associated with the magnitude of change. Zhu (2014) describes student growth percentiles as change norms that allow every student to demonstrate high or low growth or improvement. "Because pretest and posttest scores are compared to corresponding absolute criteria and differences between scores are evaluated based on a norm, student growth percentiles can also be considered "mixed" evaluation approach, which includes the advances of norm-and criterion-referenced assessments and pretest and posttest change" (Zhu, 2014). Clauser (2016) describes student growth percentiles as a norm-referenced rather than a criterion-referenced approach that measures a student's relative standing within a group rather than a standing relative to the content being tested.

In calculating student growth percentiles, Betebenner (2011) used quantile regression to establish curvilinear functional relationships between the cohort's prior scores and the cohort's current scores. Specifically, for each grade by subject cohort, quantile regression is used to establish 100 (1 for each percentile) curvilinear functional relationships. These cut points are the percentiles of the conditional distribution associated with the individual's prior achievement. Student growth percentiles provide information on the propensity of a student to achieve a predetermined target score and whether the student is performing as would be expected from identical students with the same history of academic achievement. Student growth percentiles are the growth ranking of students in percentiles among students who have an identical history of learning and student growth percentiles are based on a history of scores. (Seo, McGrane, & Taherbhai, 2015).

Benefits of using student growth percentiles

There are many benefits to using student growth percentiles to assess student achievement over time. Student growth percentiles allow growth to be analyzed descriptively and also qualified in terms such as "reasonable" and "appropriate" (Betebenner, 2009). Boiarska & Zhu (2014) state that a standard setting procedure using external criteria such as the growth related to a state's performance standards combined with stakeholders' input allows for qualifying student growth percentiles as "low," "typical"' or "high." States can also qualify student growth by defining ranges of growth percentiles. For example, the Colorado Growth Model designates growth percentiles between 35 and 65 as being typical. That is, by defining a future (e.g., a three year) achievement target for each student, this shows how growth percentile analyses can be used to quantify what level of growth, expressed as a per/year growth percentile, is required by the student to reach his/her achievement target.

Seo, McGrane and Husein (2015) studied the role of student growth percentiles in monitoring learning and predicting learning outcomes. Student growth percentiles can serve as an initial indicator of a student's learning progress. They also found that the student growth percentile method may, besides providing a normative comparison of students with an identical history of achievement, also indicate how much the student needs to perform in relation to peers to obtain a predetermined target score.

Another benefit of student growth percentiles is that they give students "credit" for learning if they did not increase according to the achievement levels created in the state. For example, if a child received an achievement classification of "basic" in 4th grade, and also received a classification of "basic" in 5th grade, it is hard to quantify how much "growth" took place, if any, over the course of that year. Again, by ranking students relative to each other, student growth percentiles attempt to link changes in the rankings to change in learning across years (Bettebenner, 2009).

A major benefit of student growth percentiles, according to Bettebenner (2011), is that they do not require assessments with a vertical scale. This factor has been a particular challenge for other value-added measures (Bettebenner, 2011). Student growth percentiles require longitudinal data, but not a vertical scale. Many statewide tests in reading and math are not on the same scale from grade to grade. Therefore, talking about "how much" a student learned from say 4th grade to 5th grade, is not easily quantifiable and student growth percentiles address this problem.

For accountability purposes, student growth percentiles allow for the ability to use group means. Amrein-Beardsley (2014) finds that student growth percentiles may be used to determine if students have increased, decreased or remained the same in their growth percentiles when

compared to similar peers. Further, that growth is quantified through norm-referenced scores that can be collapsed and used at the teacher, school or district level.

Including demographics in the student growth percentile model

A key feature of the student growth percentiles using Betebenner's quartile regression model according to Ehlert, Koedel, Parsons, and Podgursky (2014), is that it does not take into account student characteristics, such as race and poverty status, or schooling environments. Advocates of student growth percentiles and other growth models that do not consider these factors view this as an advantage as they worry that methods that do take into account student or school-level demographic characteristics may set lower expectations for disadvantaged students. They find no systematic relationships between teacher or principal MGPs and the percent of students with disabilities, English language learners, or economically disadvantaged students in classrooms or schools, indicating that the model continues to enable all educators to receive any growth score result, regardless of the characteristics of their students.

Critics of student growth percentile-type metrics counter that not taking these differences into account may, in fact, penalize schools that serve disadvantaged students, which tend to have lower rates of test-score growth for reasons that may be at least partly out of their control (Ehlert, Koedel, Parsons, & Podgursky, 2014) Ehlert et al. (2014) recommend that states using aggregate student growth percentiles should not compare high-poverty schools to low-poverty schools. Shang, VanIwaarden, and Betebenner (2015) found that student growth percentiles tend to be overestimated among students with higher achievement and underestimated among those with lower prior achievement.

The importance of including test scores from students with disabilities in teacher evaluations is studied by Buzick and Jones (2015), and they found that overall, including or

excluding the scores from students with disabilities appears to matter for teachers who teach many students with disabilities and little for teachers who teach few. Their findings suggest that including scores from students with disabilities allows more teachers to be evaluated and does not substantially affect teachers' scores. It may allow for fairer evaluations for teachers with many students with disabilities in their class. However, they caution that there is a lack of research that evaluates the consequences of including statistical controls for testing accommodations that can affect test performance regardless of teacher inputs (Buzick & Jones 2015).

Adjusting growth measures to account for student variability, such as disability, has been explored as a means of increasing validity. Including disability-related covariates can allow for fairer evaluations for teachers with many students with disabilities in their class (Buzick, Service, & Jones, 2015). Including statistical controls for special education status or specific disability categories is an increasingly common approach (American Institutes for Research, 2015).

Additionally, for the student growth percentiles, there is a clear relationship between the school growth measures and the socioeconomic status of the student body and that schools with more students who are eligible for free or reduced lunch tend to have lower growth scores. In the case of the student growth percentile approach, this reflects the fact that low-SES students make less progress, on average than high-SES students, even after conditioning on prior test performance (Sireci, Wells, & Keller, 2017).

The New York State student growth percentile model

As a result of these concerns regarding student growth percentiles based on quartile regression, some states, such New York, developed hierarchical linear modeling that adjusts for

certain student variables to predict a current year assessment score conditioned on three prior test scores. Included in this model are additional calculations intended to control for measurement variance in predictor variables and decrease biases associated with treating observed scores as if they were true scores (Beeler, 2014).

The New York State Growth Model for Educator Evaluation 2016/17 Technical Report cites concerns in using the quantile regression method to calculate student growth percentile. First, the typical implementation of the quantile regression does not correct measurement variance in the predictor variables or the outcome variable. Models that ignore the measurement variance in the predictor variables lead to bias in the model coefficients. Further complicating the issue, the measurement variance in the outcome variable also adds to the bias in quantile regression, an issue that does not occur with linear regression.

In New York, "To measure student growth and attribute that growth to educators, at least two sources of data are required: student test scores that can be observed across time and information describing how students are linked to schools, teachers, and courses (i.e., identifying which teachers teach which students for which tested subjects and which school(s) those students attended). In addition, New York State models also use other information about students and schools, such as student demographics" (NYSED Growth Model Technical Report, 2017).

New York State further refined the definition of similar students to include additional factors known to impact student performance in order to better isolate the impact of a student's teacher on his or her performance. In the New York State growth model, the term "similar students" means not only students with the same academic history, but also ones with the same English language learner, economic disadvantage, or disability statuses. In the New York State growth model, the term "similar students" means not only students with the same academic

history, but also ones with the same English language learner (ELL), economic disadvantage, or disability statuses. Adjusted student growth percentiles were intended to address peer effects by comparing growth to students with similar characteristics.

> "At the core of the New York State growth model is the production of a student growth percentile. This statistic characterizes the student's current year score relative to other students with similar measured characteristics and prior test score histories. For example, an student growth percentile equal to 75 denotes that the student's current year score is the same as or better than 75% of the students in the State with prior test score histories and other measured characteristics that are similar. It does NOT mean that the student's growth is better than that of 75% of all other students in the population." (Growth Model for Educator Evaluation 2016/17 Technical Report, 2017, p.21)

Simply put, if student A with an English language arts score of 320 in a given year is compared to other students who also had scores of 320 in that same year, student A's English language arts test score in that year was in the middle range when compared to those same students. "We can describe Student A's growth relative to similar students as a "student growth percentile" or SGP. In this example, because Student A's SGP is 44 (Student A scored 4th out of 9 similar students; 4 divided by 9 equals 44% or an SGP of 44), it means that this student achieved an English language arts test score as high or better than 44 percent of other students (with the same starting point and characteristics). SGPs range from 1–99 and they always tell you where a student stands in a distribution of similar students (specifically, what share of students he or she performed the same as or better than). In New York State's evaluation system, SGPs are calculated separately by subject and grade" (Education Analytics, 2018, p. 2).

Zhu (2014) states that more than 20 states in the United States have started to use student growth percentiles for assessing and evaluating student learning and teacher effectiveness. Amrein-Beardsley (2014) indicates that the Student Growth Percentile is the most commonly used model by states to assess student growth. She goes on to describe the student growth percentile model as intentionally designed as a normative method for describing student growth

in an academic year. This model, according to Amrein-Beardsley can be used to facilitate discussion and reflection but should not be used for decisions of high consequence. "The student growth percentile model was, and still is, designed to serve not as an absolute or supreme but as a descriptive measure of student growth during an academic year" (Amrein-Beardsley, 2014, p.66).

Concerns with the use of student growth percentiles

The literature suggests that students' growth percentiles should be used responsibly and should not be used for high stakes decisions for individual teachers. States might want to be cautious in using student growth percentiles for teacher evaluation according to Lash, Makkonen, Tran, and Huang, (2016). They conclude that growth scores alone may not be sufficiently stable to support high-stakes decisions and suggests the need to examine measures of teacher effectiveness and their interpretation in evaluation systems. The growth score may not be a sound measure of a teacher's effectiveness, or the magnitude of a teacher's effect on student learning may not be as predictable a trait of the teacher as many evaluation systems assume it is. (Lash et al., 2016)

Due to their intuitive appeal and minimal reliance on scale assumptions, Lockwood and Castellano (2015) conclude that student growth percentiles will continue to be used as part of education research, practice, and reporting but also found several fundamental limitations. First, they state that student growth percentiles are intrinsically normative and do not provide information about achievement progress in absolute terms. Second, student growth percentiles place students on a continuum of relative achievement status that is conditional on past achievement and does not indicate whether the progress of a typical student is adequate or meets the expectations of the educational system.

Additional cautions regarding student growth percentiles cited by Clauser, Keller and McDermott (2016) after studying principals' uses and interpretations of student growth percentile data are that as these models are relatively new, and it is unlikely that professional development for educators has been able to keep pace with the rapid development and implementation of growth models. Therefore, as models become increasingly sophisticated, there is an increased likelihood that school leaders will misinterpret or poorly apply the data to decision making as they do not fully understand the complex measurements and therefore states should be cautious with the use and interpretation of this data of this data.

As a result of continued research findings questioning the reliability and validity of student growth percentiles, some states such as New York, are using the scores for advisory purposes during a transition period, as it is still required that State-provided growth scores be incorporated into Annual Professional Performance reviews for educators. However, they will not be used for determinations of professional performance reviews of teachers or principals scores at least through the 2018-19 school year (Schwartz, 2017).

Mean growth percentiles for program evaluation

Despite concerns regarding using student growth percentiles for teacher evaluation, research suggests that there is merit in using mean growth percentiles for program evaluation (Choi & Liu, 2017; Monroe, 2015). Aggregating student growth percentiles for all individuals who are associated with a group of interest (e.g., teacher, school, or district) provides information to administrators and stakeholders about the performance of an entire group on a test. When tied to the evaluation of educational effectiveness, this information may be useful for accountability decisions. As demonstrated in Choi and Liu (2017), the student growth percentile measurement errors had higher degrees of consistency/precision at the aggregated level than at

the student level. Thus, if the aggregated student growth percentiles, such as mean student growth percentile or median student growth percentile, are reported, it is likely that the student growth percentile results are reliable regarding their measurement errors. Further study of student growth percentiles should focus on the reliability and validity of the scores as well as how they are used and interpreted; however, research suggests that they may be used descriptively to evaluate program effects. Monroe (2015) also found that student growth percentile estimates at the student level may have low reliability while aggregate estimates currently used in many states may have higher reliability.

With the New York State student growth percentile calculations readily available on state assessments in English language arts and mathematics the opportunity presents itself to compare the achievement growth of students is the integrative co-taught classroom based on the New York definition to students who attend traditional classrooms.

Research questions

The specific questions answered in this study center around the impact of participation in an integrated co-taught classroom on academic achievement in English language arts and mathematics. This analysis was accomplished by comparing groups of students across grades and years using Student Growth Percentiles on the NYSED English Language Arts and mathematics assessments.

This study explored four research questions for each area of English language arts and mathematics, (1) Is there a significant difference in the mean student growth percentiles in English language arts and mathematics for all students in grades four through six who attended an integrated co-taught classroom class compared to all students who attended a traditional classrooms? The research question explored whether there is a significance difference in the

average achievement growth between these two groups. The independent variable in this question was participation in an integrated co-taught classroom. The dependent variable was the student Student Growth Percentile on the 4-6 NYSED English language arts and mathematics exams. The null hypothesis was that there was no significant difference in the average student growth percentile of students attending integrated co-taught classroom classrooms compared to students in traditional classrooms. If the null hypothesis was rejected, then the direction of the impact was explored.

(2) Is there is a significant difference between the average student achievement growth in English language arts and mathematics for all students not identified with an educational disability in grades four through six who attended an integrated co-taught classroom class compared to students not identified who attended traditional classrooms using the New York State Assessments student growth percentiles? The independent variables in this study was participation in an Integrated co-taught classroom and the disability status of the students. The dependent variable was the student Student Growth Percentile on the 4-6 NYSED English language arts and Math Assessments. The null hypothesis was that there is no significant difference in the average student growth percentile of students not identified as having a disability attending integrated co-taught classroom classrooms compared to similar students in traditional classrooms. If the null hypothesis was rejected, the direction of the difference was be explored.

(3) Is there is a significant difference in the average English language arts and math achievement growth for students with disabilities (SWD) in integrated co-taught classrooms compared to students with disabilities in all other special education settings? The null hypothesis was that there is no difference in achievement growth between students with disabilities in

integrated co-taught classrooms versus students with disabilities in other special education programs. If the null hypothesis was rejected, the direction of the difference was explored. It should be noted that students with disabilities in other educational settings generally are less impacted by their disability and therefore do not require full-day special education support. These students all attended a traditional classrooms for most of the day and received pull out supplemental support through resource or related services or push in support for periods generally no longer than one hour.

(4) Is there is a significant difference in the average English language arts and mathematics achievement growth between students with disabilities compared to students without disabilities within integrated co-taught classroom classrooms? This analysis was done to assess whether there is a difference in how integrated co-taught classrooms impacts achievement for students with disabilities compared to their peers without disabilities. The null hypothesis was that there is no difference in English language arts and math average achievement growth for students with disabilities compared to students without disabilities in Integrated co-taught classroom classrooms. If there was a significant difference, then the direction of the difference was explored.

This study hypothesized that there will be significant differences between the average student growth percentiles for students with disabilities in integrated co-taught classrooms when compared to students with disabilities in typical classroom settings. It was predicted that participation in an integrated co-taught classroom will result in a significantly higher average student growth percentile compared to the average student growth percentile for students with a disability who participated in traditional classrooms. Although results could have been confounded by the level of disability for students in the different programs, as students who

participate in integrated co-taught classrooms are generally more impacted by their educational disabilities than the students with disabilities in other programs. It was further hypothesized that the achievement for students not identified participating in integrated co-taught classrooms would not be significantly different from their peers taught in traditional classrooms. The literature base does not include direct comparisons of academic growth for students with a disability and students not identified within an integrated co-taught classroom setting or differences in findings between English language arts and mathematics.

Chapter III

Methodology

This chapter outlines the methodology of this study. It begins with a description of the research design that was used to answer the research questions. A statement regarding the positionality of the researcher in the study is followed by a description of the setting of the study. Next, the participants, treatment, and measures are discussed. The procedures and data analysis for the study are described followed by a thorough outline of each research question included in the study. Finally, there is an overview of the reliability and validity of the study, ethical considerations, and limitations.

Research Design

This study was causal-comparative and provided a descriptive analysis of the impact of participation in integrated co-taught classroom classrooms compared to traditional classrooms on the academic growth of students with and without disabilities in English language arts and mathematics using student growth percentiles. It employed a quasi-experimental design as the researcher assigned students to traditional and integrated co-taught classrooms based on district practices and not for the purposes of this study and post hoc statistical analysis using t-tests were run to look for statistical significance in differences between identified groups. The two-level treatment variable for this study was participation in an integrated co-taught classroom or a traditional classroom. A two-level attribute variable included in the study was disability status. Students were identified as having a disability or not having a disability. The outcome variable was academic achievement growth in ELA and mathematics. The outcome variable was operationalized as the student growth percentile on the NYS assessments. Group means were compared. Extraneous variables in the study included teacher characteristics, instructional

practices, and building culture. Constants across the sample included district policies regarding class size and location within the same school district.

Data was collected and assigned anonymous numbers so that all student information was kept confidential. Students missing data were not included in the sample. Opt-outs were assumed to be constant across the state as district opt-out rates were comparable to the state.

Positionality

As an administrator of special education for the past eighteen years, it has been evident that educators, parents, advocates, and researchers continue to question the impact that co-teaching has on the achievement of students with disabilities. They also question the effect of including students with diverse learning challenges on students who have not been identified as having an educational disability. Conflictingly, New York State Regulations continue to allow for pull-out services and self-contained classes while also guiding districts to place students in the least restrictive environment. The reasons posited for pull-out and self-contained settings are many. Parents of students with disabilities fear that their children will not receive intensive instruction, be ignored or even bullied. Parents of students not identified fear the curriculum will be slowed or watered down or that students with disabilities will be disruptive. Advocates charge that decisions are made based on cost and convenience and researchers and administrators struggle to measure the impact of co-teaching on students objectively.

This researcher's career as a school psychologist began 25 years ago when special education was evolving quickly to meet the demands of Public Law 94-142 in 1975, allowing all students to attend public schools. It was not lost on me that had I been born with a severe disability I might not have been allowed to attend school. My early foray into serving children with disabilities began as a paraprofessional in a residential setting for students with severe

disabilities. I then spent a year in a special day school for children with autism. From there I worked for a Board of Cooperative Education where all students were served in segregated special classes. Each setting allowed me to see the effects of separation and low expectations. As a result of these experiences, I began my administrative career looking to create general education classrooms that could meet the needs of all students. It is my core belief that co-teaching could offer the optimal setting for educating all students. It is critical; however, that co-teaching be implemented using the best practices identified in the research.

While I believe that there are many significant benefits from co-teaching, the impact on academic achievement is primary in the current political climate of accountability. For this reason, I have chosen to study the effect of New York State's integrated co-teaching model on the academic growth of elementary students in English language arts and mathematics achievement using the Student Growth Percentiles provided for common assessments developed by New York State Education Department (NYSED) as a means of assessing academic growth. It must be disclosed that this author serves as the Executive Director of Special Education for the district in this study. This fact is the reason for the empirical, quantitative basis for this study. NYS assessments are an objective measure that will minimize the impact of research bias. The information from this study will inform the district on the efficacy of the co-teaching program and allow for adjustments if warranted.

Setting

The setting for this study was a large suburban school district in Central New York comprised of approximately 7,200 hundred students. There are nine elementary school buildings that house students in kindergarten through sixth grade. According to the NYSED website, the demographics of the district for the 2016-17 school year included a 19% identification rate for

students with disabilities with 85.1% of students included in the general education setting for 80% or more of the school day in the 2016-17 school year. (This compares to the national rate of 65.53% of students and the New York State rate of 57.98% of students spending 80% or more of the school day being educated in the general education classroom (OSEP, 2018). Socioeconomically, 42% of students are economically disadvantaged. Racially, the district is comprised of 75% white students, 9% Black or African American, 5% Hispanic or Latino, 5% Asian or native Hawaiian, and 5% multiracial.

Integrated co-taught classrooms have been implemented in kindergarten through sixth-grade classrooms for the past twelve years in addition to the New York State continuum of services that includes related services, consultant teacher services, resource room and special classes for students with severe disabilities who receive an alternate assessment to the state test. A traditional classroom setting is comprised of one elementary certified general education teacher with an average of 22 students. An integrated co-taught classroom is consistently staffed with one general education teacher co-teaching with a special education teacher and a certified program teaching assistant for the full day. Some students in the integrated co-taught classroom classrooms may also have a one to one teaching assistant assigned.

The average class size of the integrated co-taught classroom classrooms is generally comparable to the traditional classrooms and averages around 22 students with no more than 12 students with disabilities. The number of students with disabilities in the co-taught classrooms ranges from six to twelve. There is not a consistently required co-teaching methodology, and teams have a variety of experience in co-teaching. Students are placed into integrated co-taught classrooms based on the Committee on Special Education process and through building procedures that include balancing classroom needs based on academic and social-emotional

factors. Students placed in integrated co-taught classrooms due to special education needs may participate in integrated co-taught classroom classes for a number of years and non-identified students may participate in integrated co-taught classrooms for multiple years or not at all.

Participants

The participants in this study are the approximately 2,200 students who attended the district each year during the 2013-15 school year through the 2017-18 school years in grades four through six and were provided a Student Growth Percentile as a result of taking the NYSED assessments in English language arts and mathematics. The students with disabilities included in this study include the full range of disabilities identified in the NYSED special education regulations; however, the largest percentages within the district are students with learning disabilities, speech and language impairments, and other health impairments. Students who are recommended for the integrated co-taught setting by the Committee on Special Education are generally impacted moderately by their disability across more than one area such as reading, math or behavior and require full-day modifications and support in order to make adequate educational progress. It does not include students with severe disabilities who participate in the New York State Alternative Assessment even if they had participated in a co-taught classroom as student growth percentiles were not available. Students were included in this study if they were identified as attending LCSD and included in the study if they were registered on October 1 and present for the NYS English language arts assessment for the 2014-2018 school years. Students in grades four through six were selected because the NYS student growth percentiles would be readily available to compare student growth in the areas of English language arts and mathematics. Further, integrated co-taught classrooms are only implemented through the sixth grade in the district.Each of the nine elementary schools in the district would typically have two

to three sections of each grade level for a range of 18-25 total classrooms.

The number of sections of integrated co-taught classrooms was based on the total number of students requiring this placement and adhering to district policy and New York State Regulations for class size. Each grade level would typically have three or four integrated co-taught classrooms. Therefore, not very elementary school houses integrated co-taught classrooms at every grade level. As a result, some students are transported to schools other than their home schools in order to attend an integrated co-taught classroom at their grade level.

Treatment

The treatment in this quasi-experimental study was participation in an integrated co-taught classroom. Because of the post hoc design of the study, it should be clear that the effects of co-teaching were examined after students were placed in classroom settings based on district practices and they were not assigned a classroom for experimental research purposes. As result, the study is causal comparative and academic effects cannot be directly attributed to the type of classroom in which the students participated.

The maximum number of students with disabilities receiving integrated co-teaching services in a class was determined in accordance with the students' individual needs as recommended on their individualized education plans, provided that the number of students with disabilities in such classes did not exceed 12 students or 50% of the students in the classroom as per state regulation. The only variable that will hold for all integrated co-taught classroom settings is the staffing of the classrooms which includes a general education teacher, a special education teacher and a program teaching assistant for integrated co-taught classrooms for the full school day and one general education teacher for the traditional classrooms. The reader may make no other assumptions regarding the methodology or quality of instruction.

Measures

For this study, the outcome areas of English Language Arts and mathematics were selected by this researcher for study because of the importance of strong literacy and math skills for later academic success. Students in grades four through six were selected because the NYS student growth percentiles would be readily available to compare student growth in the areas of English language arts and mathematics and could be used to objectively and operationally define student growth. The instrumentation used was the NYS Testing Program English language arts and mathematics assessments as these were standardized and objective and can be used to create comparisons between students using the student growth percentiles across the state. Academic growth in both English language arts and mathematics were operationally defined using NYSED student growth percentiles which offer good face validity for what they are purported to measure when aggregated and do not rely on a vertical scale. Any concerns regarding the reliability and validity of the assessments were considered because this study is looking for group differences and therefore validity and reliability concerns will be spread across all subjects. Due to the nature of student growth percentiles they can confidently be used for program evaluation and group comparisons (Betebenner, 2009). Further, mean growth percentiles have greater validity than individual student growth percentiles (Choi & Liu, 2017).

Procedures

This study compared group means of student growth in relation to the independent variables of disability (students with a disability/students not identified) and classroom setting (integrated co-taught classroom/traditional) by grade level by year. Descriptive statistics were run for each year and grade including mean, standard deviation, and variance. The study was

granted approval under Syracuse University's IRB as meeting the exempt status and meeting the organization's ethical standards.

Ethical concerns are minimized by the objectivity of quantitative, state-provided data. The fact that the researcher is responsible for the educational growth of students with disabilities in the district is a consideration.

Data Analysis

First, a one-sample t-test was conducted to assess whether the sample is significantly different from the state population in reading and math using the 50th student growth percentile as the population mean. Then differential inferential statistics were used to evaluate for differences between groups in the population from which the sample was drawn to determine if there was a statistical difference between the groups. This analysis was done by grade level and year for five years for a total of 15 different analyses.

The study design compared groups based on two factors, participation in an integrated co-taught classroom or traditional classroom, and disability status, and comparing students with a disability to students not identified as having an educational disability. The study used a mixed factorial design using two factors: integrated co-taught classroom/traditional classrooms and disability status students with a disability/ students not identified each having two levels. Independent two-tailed t-tests were used to evaluate for statistical significance between the groups at an alpha level of .05 for each grade level over five years. Each grade in each year was analyzed separately to control for cumulative effects. This study included students in grades four through six for the years 2014-2018. If the null hypothesis was rejected, then the direction of the effect was analyzed and the number of comparisons per year showing statistical differences was assessed.

Research question 1

Is there a difference between the average academic growth for all students in integrated co-taught classrooms compared to all students in traditional classrooms for English language arts? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there was a statistical difference between the average student growth percentile in English language arts of students who attend integrated co-taught classroom classrooms compared to students who attended traditional classrooms. The null hypothesis was that there is no difference between the groups. The null hypothesis was rejected if there is a statistical difference between each group.

Research question 2

Is there a difference between the academic growth for all students in integrated co-taught classrooms compared to all students in traditional classrooms for mathematics? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in the mathematics achievement of students who attend integrated co-taught classroom classrooms compared to students who attended traditional classrooms.

Research question number 3

Is there a difference in the academic growth for students not identified who attend integrated co-taught classroom compared to traditional classrooms in English language arts? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in English language arts of students not identified who attend Integrated co-taught classroom classrooms compared to students not identified who attended traditional classrooms.

Research question number 4

Is there a difference in the academic growth for students not identified who attend integrated co-taught classroom compared to traditional classrooms in mathematics? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there was a statistical difference between the average student growth percentile in the mathematics achievement of students who attend Integrated co-taught classroom classrooms compared to students who attended traditional classrooms.

Research question number 5

Is there a difference in the academic growth for students with a disability compared to students with disabilities who receive other special education supports in traditional classrooms in English Language Arts? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in English language arts of students with a disability who attend integrated co-taught classroom classrooms compared to students not identified who attended an Integrated co-taught classroom.

Research question number 6

Is there a difference in the academic growth for students with disabilities who attend integrated co-taught classroom compared to students with disabilities who attend traditional classrooms and receive other special education supports in mathematics? Independent, two-tailed t-tests was conducted for each grade level by year to determine if there was a statistical difference between the average student growth percentile in the mathematics achievement of students who attend integrated co-taught classrooms compared to students who attended traditional classrooms.

Research question number 7

Is there a difference in the academic growth for students with a disability compared to students not identified within an integrated co-taught classroom in English language arts? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in English language arts of students with a disability who attend integrated co-taught classroom classrooms compared to students not identified who attended an integrated co-taught classroom classrooms.

Research question number 8

Is there a difference in the academic growth for students with a disability compared to students not identified within an integrated co-taught classroom in mathematics? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there was a statistical difference between the average student growth percentile in the mathematics achievement of students with a disability who attend integrated co-taught classroom classrooms compared to students not identified who attended integrated co-taught classrooms

Chapter IV

Results

The focus of this study was to complete a causal-comparative and descriptive analyses of the impact of participation in integrated co-taught classrooms on the academic growth of students with and without disabilities compared to participation in traditional classes using student growth percentiles as the metric for assessing academic growth. The comparisons were analyzed for English language arts and mathematics. A series of t-tests were run to look for statistical significance in differences in academic growth between identified groups and educational settings.

This study included the two-level group comparisons of treatment variables of students who participation participated in an integrated co-taught classroom or a traditional classroom looking for significant differences in academic growth. A second two-level attribute variable studied was disability status. Students Groups of students were compared based on were whether they were identified as having a disability or not identified as having a disability. This study employed a mixed factorial causal comparative design comparing groups based on two factors: educational setting: integrated co-taught classroom/traditional classrooms, and disability status: students with a disability/students not identified. The outcome variable was growth in academic achievement in English language arts and mathematics as measured by the New York State annual testing program student growth percentiles. Independent two-tailed t-tests were used to evaluate for statistical significance with an alpha level of .05 for each grade level and year over five years. This study included students in grades four through six for the years 2014-2018.

Findings

First, an exploratory one- sample t-test was conducted to assess whether the sample was

representative of the state population in English language arts using 50 as the student growth percentile population mean.

Table 4.1

One sample t-test ELA all students compared to SGP of 50 (2014-2018)

	N	M	St. Dev.	*t*	*df*	*p*
All Students	6240	50.49	27.02	1.432	6239	.152

p<.05

There was no significant difference in the overall mean of the total sample over five years (*M*=50.49, *SD*=26.02) *t* (6239)=1.432, *p*=.15) (See table 4.1). These results suggest that the mean of the sample is not significantly different than the population as a whole. Therefore, the sample is a good representation of the state population as a whole, and the scores are normatively distributed. These results suggest that the overall sample grew at the expected average rate when compared to the state population in English language arts.

Next, a one-sample t-test was conducted to assess whether the sample is significantly different than the state population in math using the 50 as the student growth percentile population mean.

Table 4.2

One sample t-test mathematics all students mean SGP compared to SGP of 50 (2014-2018)

	N	M	St. Dev.	*t*	*df*	*p*
All Students	61116111	51.7051.7	27.0827.08	4.891.432	61106239	.001.152

p < .05* p<.01**

There was a significant difference in the overall mean of the total sample over five years (*M* = 51.7,0 *SD* = 27.08) *t* (4.89) *df = 6110* =, *p*=<.001. (See table 4.2) These results suggest that

the mean of the sample is significantly higher than the population as a whole. However, when the effect size is calculated using Cohen's d (d = t / sqrt(N) resulting in a value of .07 suggesting a small effect size. This calculation suggests the sample mean is significantly higher than the whole state's population mean in mathematics, but the difference is small.

Next, differential inferential statistics were used to evaluate for differences between groups means in the sample to determine if there was a statistical difference between the groups. This analysis was done by grade level and year for five years. Independent two-tailed t-tests were used for each analysis to evaluate for statistical significance at an alpha level of .05 or .01 for each grade level over five years. Each grade in each year was analyzed separately to control for cumulative effects. This study included students in grades four through six for the years 2014-2018. The results are as follows:

Research question 1

Is there a significant difference between the academic growth for all students in integrated co-taught classrooms compared to the academic growth for all students in traditional classrooms in English language arts? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there was a statistical difference between the average English language arts student growth percentile of students who attend integrated co-taught classrooms compared to students who attended traditional classrooms. The null hypothesis is that there is no significant difference between the mean SGP of these two groups. An alpha level of .05 was used to determine significance for each comparison.

Table 4.3

ELA growth for all students in ICT vs. Traditional classrooms

		ICT			Trad					
Year	Gr.	N	M	SD	N	M	SD	*t*	*df*	*p*
2014	4	166	52.20	26.53	368	47.95	26.82	-1.70	532	.089
	5	117	48.71	26.58	397	49.39	25.83	0.25	512	.804
	6	260	45.41	28.40	308	47.89	24.99	1.104	566	.270
2015	4	51	47.55	30.39	367	47.14	26.26	-0.102	416	.919
	5	70	61.37	25.14	311	54.58	26.13	+1.98*	379	.049
	6	41	51.61	28.24	350	52.51	26.24	0.21	389	.838
2016	4	71	50.07	29.66	297	45.59	26.68	-1.24	366	.215
	5	71	54.45	28.70	288	49.04	27.04	-1.49	357	.137
	6	56	45.30	30.62	272	48.76	27.19	0.85	326	.397
2017	4	52	51.83	27.80	364	50.43	25.30	-0.37	414	.714
	5	80	54.98	27.01	316	45.93	26.71	+2.70**	394	.007
	6	84	50.65	26.20	278	47.79	25.75	-0.89	360	.374
2018	4	69	46.55	28.47	307	54.05	27.57	-2.03*	374	.043
	5	53	53.91	30.07	362	52.56	28.20	-0.32	413	.748
	6	76	63.16	25.48	336	60.83	26.34	-0.70	410	.484

p<.05* p<.01**

No significant differences were found between the average growth in English language arts for students in ICT classrooms compared to traditional classrooms for twelve out of fifteen grade level comparisons (three grades for five years). In two comparisons the null hypothesis was rejected with an alpha level of .05 as the students in the integrated co-taught classrooms did significantly better (both grade 5). ($M1 = 61.37$, $M2 = 54.58$, $t = 1.98$, $df = 379$, $p = .049$) ($M1 =$

54.98, $M2 = 45.93$, $t = 2.70$, $df = 394$, $p = .007$). (See table 4.3) In one comparison the students did significantly better in the traditional classroom (grade 4) ($M1 = 46.55$, $M2 = 54.04$, $t = -2.03$, $df = 374$, $p = .043$). In summary, 80% (12/15) of the comparisons found no difference between the growth of the students in the integrated co-taught classes compared to the traditional classes in English Language Arts, 13% (2/15) of the comparisons resulted in greater academic growth for students in integrated co-taught classrooms and 7% (1/15) of the comparisons resulted in greater academic growth for students in traditional classrooms.

Research question 2

Is there a difference between the academic growth for all students in integrated co-taught classrooms compared to the academic growth for all students in traditional classes for mathematics? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in mathematics for students who attended integrated co-taught classrooms compared to the average student growth percentile for students who attended traditional classes.

Table 4.4

Mathematics growth for all students in ICT vs. Traditional classrooms

		ICT			Trad					
Year	Gr.	N	M	SD	N	M	SD	*t*	*df*	*p*
2014	4	164	52.23	24.55	365	51.51	26.75	-0.296	527	.768
	5	114	34.05	23.40	392	39.58	25.69	2.060*	504	.04
	6	252	57.08	25.02	306	52.6	25.30	-2.093*	556	.037
2015	4	51	55.76	25.13	349	46.96	25.33	-2.321*	398	.021
	5	62	48.85	25.58	392	39.58	25.69	-3.33*	333	.001
	6	36	57.36	29.07	36	57.36	29.07	-0.705	374	.481
2016	4	69	56.28	23.81	299	50.69	26.96	-1.585	366	.114
	5	71	48.08	28.47	285	45.86	26.10	-0.63	354	.529
	6	51	56.27	24.27	249	57.49	25.96	0.307	298	.759
2017	4	52	43.65	27.38	356	54.1	26.01	2.687*	406	.008
	5	77	49.66	26.73	302	42.53	28.07	-2.01*	377	.045
	6	86	74.38	22.32	274	52.77	23.46	-7.539*	358	.001
2018	4	69	62.67	26.21	348	63.2	25.72	0.156	415	.876
	5	49	45.9	28.73	367	47.48	26.58	0.388	414	.698
	6	70	68.67	26.14	332	69.45	24.20	0.24	400	.811

p<.05* p<.01**

The null hypothesis for this comparison is that there is no difference in the average academic growth in mathematics for students in ICT classrooms compared to students in

traditional classrooms. The null hypothesis was not rejected for ten out of fifteen comparisons, as there were no significant differences between the two group means. In five comparisons the null hypothesis was rejected as the students in the integrated co-taught classrooms did significantly better. One year fourth grade ICT students did better ($M1 = 55.76$, $M2 = 46.92$, $t = 2.321$, $df = 398$, $p = .021$). Fifth grade ICT students did better for two years ($M1 = 48.85$, $M2 = 39.58$, $t = 3.33$, $df = 333$, $p = .001$) ($M1 = 49.66$, $M2 = 42.53$, $t = 2.01$, $df = 377$, $p = .045$). Sixth grade ICT classes did better for two years ($M1 = 57.08$, $M2 = 52.6$, $t = 2.093$, $df = 556$, $p = .037$) ($M1 = 74.38$, $M2 = 52.77$, $t = 1.418$, $df = 398$, $p = .001$). In two yearly comparisons the students did significantly better in the traditional classroom. One year fourth graders in traditional classes did better than students in ICT classes ($M1 = 43.65$, $M2 = 54.1$, $t = 2.687$, $df = 406$, $p = .008$). Fifth graders in traditional classes did better than students in ICT classes for one year ($M1 = 34.05$, $M2 = 39.58$, $t = 2.06$, $df = 504$, $p = .04$). (See Table 4.4) Therefore, in summary, 53% (8/15) of the comparisons found no difference between the growth of the students in the integrated co-taught classes compared to the traditional classes in English Language Arts, 33% (5/15) of the comparisons resulted in greater academic growth for students in integrated co-taught classrooms and 13% (2/15) of the comparisons resulted in greater academic growth for students in traditional classrooms in mathematics.

Research question number 3

Is there a difference in the academic growth for students not identified as having a disability (SNI) who attend integrated co-taught classroom compared to traditional classrooms in English language arts? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile

in English language arts of students not identified who attend integrated co-taught classroom classrooms compared to students not identified who attended traditional classes.

Table 4.5

ELA growth for all SNI as having a disability in ICT vs. Traditional classrooms

			ICT			Trad				
Year	Gr.	N	M	SD	N	M	SD	*t*	*df*	*p*
2014	4	110	47.20	25.03	325	46.58	26.43	-0.21	433	0.831
	5	77	43.52	24.56	280	54.22	25.81	1.76	418	0.079
	6	187	42.21	27.57	267	46.50	23.99	1.76	452	0.079
2015	4	29	52.97	29.66	320	45.84	25.99	-1.40	347	0.163
	5	43	63.44	22.81	280	54.22	25.81	-2.21*	321	0.028
	6	19	49.58	26.64	301	51.45	26.58	0.30	318	0.767
2016	4	47	44.45	28.38	260	45.90	26.23	0.35	305	0.730
	5	42	58.29	26.80	254	48.76	27.10	-2.11*	294	0.035
	6	29	52.38	26.67	241	47.69	26.07	-0.91	268	0.362
2017	4	33	48.36	29.10	319	49.34	25.29	0.21	350	0.835
	5	43	53.40	26.43	288	45.10	26.82	-1.89	329	0.059
	6	56	50.11	23.30	252	47.05	25.26	-0.83	306	0.407
2018	4	44	45.16	30.11	265	55.19	27.24	2.23*	307	0.027
	5	31	60.42	25.55	312	52.01	27.98	-1.61	341	0.109
	6	41	69.29	23.09	301	61.49	26.16	-1.82	340	0.070

p<.05* p<.01**

In the area of English language arts, out of fifteen comparisons, twelve found no significant difference between the two classrooms (ICT vs. Trad) for students not identified as having a disability. In two fifth grade comparisons the null hypothesis was rejected as the students in the integrated co-taught classrooms did significantly better ($M1 = 63.44$, $M2 = 54.22$, $t = 2.21$, $df = 321$, $p = .028$) ($M1 = 58.29$, $M2 = 48.76$, $t = 2.11$, $df = 294$, $p = .035$). In one comparison the fourth grade students did significantly better in the traditional classroom ($M1 = 45.16$, $M2 = 55.19$, $t = 2.23$, $df = 307$, $p = .027$). (See table 4.5) Therefore, 80% (12/15) of the yearly comparisons found no difference between the growth of the students not identified in the integrated co-taught classes compared to the traditional classes in English Language Arts, 13% (2/15) of the comparisons resulted in greater academic growth for students in integrated co-taught classrooms and 7% (1/15) of the comparisons resulted in greater academic growth for students in traditional classrooms.

Research question number 4

Is there a difference in the academic growth in mathematics for students not identified who attend integrated co-taught classrooms compared to traditional classrooms? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in the mathematics of SNI who attend integrated co-taught classrooms compared to the average student growth percentile for SNI who attended traditional classrooms. An alpha level of .05 was used to determine significance.

Table 4.6

ELA growth for all students not identified as having a disability in ICT vs. Traditional classrooms

		ICT			Trad					
Year	Gr.	N	M	SD	N	M	SD	*t*	*df*	*p*
2014	4	108	50.04	24.28	324	50.72	27.19	0.23	430	0.816
	5	78	32.73	21.66	339	39.09	25.23	2.06*	415	0.040
	6	182	55.99	23.45	265	51.25	25.1	-2.02*	445	0.044
2015	4	28	49.54	21.81	309	45.67	24.89	-0.79	335	0.428
	5	42	48.45	25.24	246	36.54	22.96	-3.06*	286	0.002
	6	17	51.53	31.57	292	53.75	26.66	0.33	307	0.742
2016	4	46	59.15	21.41	259	49.90	27.02	-2.20*	303	0.028
	5	42	42.57	25.60	252	45.74	25.00	0.76	292	0.449
	6	28	52.39	22.85	224	56.57	25.52	0.82	250	0.411
2017	4	33	44.67	27.46	311	52.39	25.84	1.62	342	0.106
	5	44	47.77	26.22	274	41.72	27.87	-1.35	316	0.179
	6	57	74.84	22.10	249	51.92	23.26	-6.77**	304	0.001
2018	4	43	62.95	25.45	302	63.91	24.92	0.23	343	0.815
	5	30	39.80	27.37	315	47.64	26.74	1.51	343	0.127
	6	38	76.26	20.97	299	70.26	23.93	-1.47	335	0.141

p<.05* p<.01**

Out of fifteen comparisons, ten found no significant difference between the two groups means in the area of mathematics. In four comparisons the null hypothesis was rejected as the students in the integrated co-taught classrooms did significantly better. In one fourth grade comparison the SNI did significantly better in the ICT classrooms ($M1 = 59.15$, $M2 = 49.9$, $t = 2.20$, $df = 303$, $p = .028$), two fifth grade classes ($M1 = 48.45$, $M2 = 36.54$, $t = 3.06$, $df = 286$, $p = .002$), and two sixth grade classes ($M1 = 55.99$, $M2 = 51.29$, $t = 2.02$, $df = 445$, $p = .044$) ($M1 = 74.84$, $M2 = 51.92$, $t = 6.77$, $df = 304$, $p = 0$). In one year fifth grade SNI in traditional classrooms did better than SNI in ICT classes ($M1 = 32.73$, $M2 = 39.09$, $t = 2.06$, $df = 415$, $p = .04$). (See table 4.6) Therefore, 67% of the comparisons found no difference between the growth of the students not identified in the integrated co-taught classes compared to the traditional classes in mathematics, 27% of the comparisons resulted in greater academic growth for students in integrated co-taught classrooms and 7% of the comparisons resulted in greater academic growth for students in traditional classrooms in mathematics.

Research question number 5

Is there a difference in the academic growth in English language arts for students with a disability (SWD) compared to SWD who attended traditional classrooms? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in English language arts of students with a disability who attended integrated co-taught classrooms compared to students not identified who participated in integrated co-taught classrooms in English language arts. An alpha level of .05 was used to determine significance.

Table 4.7

ELA growth for students with disabilities in ICT vs. Traditional classrooms

		ICT			Trad				
Year	Gr.	N	M	SD	N	M	SD	*t*	*df*	*p*
2014	4	56	62.04	26.87	43	58.26	27.82	-0.68	97	0.496
	5	40	58.7	27.75	54	51.15	29.24	-1.27	92	0.209
	6	73	53.6	29.07	41	56.9	29.50	0.58	112	0.564
2015	4	22	40.41	30.53	47	56	26.72	2.16*	67	0.035
	5	27	58.07	28.61	31	57.84	29.12	-0.03	56	0.975
	6	22	53.36	30.05	49	59.02	23.26	0.86	69	0.391
2016	4	24	61.08	29.58	37	43.41	29.95	-2.26*	59	0.027
	5	29	48.9	30.87	34	51.18	26.82	0.31	61	0.755
	6	27	37.7	33.18	31	57.13	34.02	2.19*	56	0.032
2017	4	19	57.84	25.00	45	58.18	24.21	0.05	62	0.96
	5	37	56.81	27.92	28	54.46	24.40	-0.35	63	0.725
	6	28	51.75	31.65	26	55	29.65	0.39	52	0.699
2018	4	25	49	25.74	42	46.81	28.89	-0.31	65	0.756
	5	22	44.73	33.98	50	56.02	29.55	1.43	70	0.158
	6	35	55.97	26.59	35	55.14	27.54	-0.13	68	0.898

p<.05* p<.01**

Out of fifteen comparisons between the average English language arts growth for SWD in ICT classrooms compared to SWD in traditional classrooms, twelve found no significant

difference between the two groups. In one yearly comparisons of fourth graders the null hypothesis was rejected as the students in the integrated co-taught classrooms did significantly better ($M1$ =61.08, $M2$ =43.41, t =2.26, df =59, p = .027). In two comparisons the SWD did significantly better in the traditional classrooms, one fourth grade comparison ($M1$ = 40.41, $M2$ = 56, t = 2.16, df = 67, p =.035), and one sixth grade comparison ($M1$ = 37.7, $M2$ = 57.13, t = 2.19, df = 56, p = .032). (See table 4.7) Therefore, 80% (12/15) of the comparisons found no difference between the growth of the students with disabilities in the integrated co-taught classes compared to the traditional classes in English Language Arts, 7% (1/15) of the comparisons resulted in greater academic growth for students with disabilities in integrated co-taught classrooms, and 13% (2/15) of the comparisons resulted in greater academic growth for students in traditional classrooms. It is important to note that SWD who attend traditional classrooms are generally less impacted by disability than those who attend ICT classes.

Research question number 6

Is there a difference in the academic growth for students with disabilities who attended integrated co-taught classrooms compared to those students with disabilities who participated in traditional classrooms in mathematics? Independent, two-tailed t-tests were conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in the mathematics achievement of students who attend integrated co-taught classrooms compared to the average student growth percentile for students who attended traditional classes.

Table 4.8

Mathematics growth for students with disabilities in ICT vs. Traditional classrooms

		ICT			Trad					
Year	Gr.	N	M	SD	N	M	SD	*t*	*df*	*p*
2014	4	56	56.46	24.73	41	57.71	22.27	0.26	95	0.799
	5	36	36.92	26.88	53	42.68	28.53	0.96	87	0.341
	6	70	59.93	28.68	41	61.37	25.11	0.27	109	0.790
2015	4	23	63.35	27.25	40	56.9	26.82	-0.91	61	0.365
	5	20	49.70	26.91	27	46.89	28.99	-0.34	45	0.736
	6	19	62.58	26.40	48	55.88	26.28	-0.94	65	0.351
2016	4	23	50.52	27.63	40	55.78	26.30	0.75	61	0.456
	5	29	56.07	30.90	33	46.82	33.81	-1.12	60	0.268
	6	23	61.00	25.6	25	65.72	28.53	0.60	46	0.551
2017	4	19	41.89	27.89	45	65.93	24.34	3.46*	62	0.001
	5	33	52.18	27.61	28	50.43	29.33	-0.24	59	0.811
	6	29	73.48	23.12	25	61.20	24.3	-1.90	52	0.063
2018	4	26	62.19	27.93	46	58.52	30.33	-0.51	70	0.614
	5	19	55.53	28.89	52	46.54	25.78	-1.26	69	0.212
	6	32	59.66	29.02	33	62.03	25.665	0.35	63	0.728

p<.05* p<.01**

In the area of mathematics, the null hypothesis is that the mean growth for SWD in ICT classrooms would be similar to the growth for SWD in traditional classrooms. Out of fifteen comparisons, fourteen found no significant difference between the two groups. In one fourth grade comparison, the null hypothesis was rejected as the students did significantly better in the traditional classroom ($M1 = 41.89$, $M2 = 65.93$, $t = 3.46$, $df = 62$, $p = .001$). (See table 4.8) Therefore, 93% (14/15) of the comparisons found no difference between the growth of the students with disabilities in the integrated co-taught classes compared to the traditional classes in English Language Arts, and 7% (1/15) of the comparisons resulted in higher academic growth for students in traditional classrooms.

Research question number 7

Is there a difference in the academic growth in English language arts for students with a disability compared to students not identified within an integrated co-taught classroom in English language arts? Independent, two-tailed t-tests will be conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in English language arts of students with a disability compared to the average student growth percentile for SNI who attended integrated co-taught classrooms.

Table 4.9

ELA Growth for SWD compared to SNI within an ICT class

		SWD			SNI					
Year	Gr.	N	M	SD	N	M	SD	*t*	*df*	*p*
2014	4	56	62.04	26.87	110	47.20	25.03	3.52**	164	0.001
	5	40	58.70	27.75	77	43.52	24.56	-3.038**	115	0.003
	6	73	53.60	29.07	187	42.21	27.57	-2.95**	258	0.003
2015	4	22	40.41	30.53	29	52.97	29.66	1.48	49	0.146
	5	27	58.07	28.61	43	63.44	22.81	1.48	49	0.146
	6	22	53.36	30.05	19	49.58	26.64	-0.42	39	0.674
2016	4	24	61.08	29.58	47	44.45	28.38	-2.30*	69	0.024
	5	29	48.90	30.87	42	58.29	26.80	1.36	69	0.177
	6	27	37.70	33.18	29	52.38	26.67	1.83	54	0.073
2017	4	19	57.84	24.10	33	48.36	29.1	-1.19	50	0.240
	5	37	56.81	27.92	43	53.4	26.43	-0.56	78	0.576
	6	28	51.75	31.65	56	50.11	23.30	-0.27	82	0.788
2018	4	25	49.00	25.74	44	45.16	30.11	-0.54	67	0.594
	5	22	44.73	33.98	31	60.42	25.55	1.92	51	0.060
	6	35	55.97	26.59	41	69.29	23.09	2.34*	74	0.022

p<.05* p<.01**

In the area of English language arts, the average growth for SWD was compared to SNI who participated in ICT classrooms. Out of fifteen comparisons, ten found no significant difference between the two groups. In four comparisons the null hypothesis was rejected as the students with disabilities grew significantly more than the students not identified: two fourth grades ($M1 = 62.04$, $M2 = 47.02$, $t = 3.52$, $df = 164$, $p = .001$) ($M1 = 61.08$, $M2 = 44.45$, $t = 2.30$, $df = 69$, $p = .024$) , one fifth grade ($M1 = 58.7$, $M2 = 43.52$, $t = 3.03$, $df = 115$, $p = .003$) and one sixth grade ($M1 = 53.6$, $M2 = 42.21$, $t = 2.95$, $df = 258$, $p = .033$). In one comparisons the students not identified did significantly better than the students with disabilities ($M1 = 37.7$, $M2 = 57.13$, $t = 2.19$, $df = 56$, $p = .032$). (See table 4.9) Therefore, 67% (10/15) of the comparisons found no difference between the growth of the students with disabilities in the integrated co-taught classes compared to students not identified. 27% (4/15) of the comparisons resulted in greater academic growth for students with disabilities in integrated co-taught classrooms compared to students not identified, and 7% (1/15) of the comparisons resulted in greater academic growth for students not identified in traditional classrooms compared to students with disabilities.

Research question number 8

Is there a difference in the academic growth for students with a disability compared to students not identified within an integrated co-taught classroom in mathematics? Independent, two-tailed t-tests will be conducted for each grade level by year to determine if there is a statistical difference between the average student growth percentile in the mathematics of students with a disability who attend integrated co-taught classroom classrooms compared to students not identified who attended integrated co-taught classrooms.

Table 4.10

Mathematics Growth for SWD compared to SNI within an ICT class

		SWD			SNI				
Year	Gr	N	M	SD	N	M	SD	*t*	*df*	*p*
2014	4	56	56.46	24.73	108	50.04	24.28	-1.60	162	0.112
	5	36	36.92	26.88	78	32.73	21.66	-0.89	112	0.377
	6	70	59.93	28.68	182	55.99	23.45	-1.12	250	0.264
2015	4	23	63.35	27.25	28	49.54	21.81	-2.01*	49	0.05
	5	20	49.7	26.91	42	48.45	25.24	-0.18	60	0.859
	6	19	62.58	26.40	17	51.53	31.57	-1.14	34	0.261
2016	4	23	50.52	27.63	46	59.15	21.41	1.43	67	0.157
	5	29	56.07	30.90	42	42.57	25.60	-2.01*	69	0.049
	6	23	61	25.6	28	52.39	22.85	-1.27	49	0.211
2017	4	19	41.89	27.89	33	44.67	27.46	0.35	50	0.729
	5	33	52.18	27.61	44	47.77	26.22	-0.71	75	0.478
	6	29	73.48	23.12	57	74.84	22.10	0.27	84	0.791
2018	4	26	62.19	27.93	43	62.95	25.45	0.12	67	0.908
	5	19	55.53	28.83	30	39.8	27.37	-1.92	47	0.061
	6	32	59.66	29.02	38	76.26	20.97	2.77**	68	0.007

p<.05* p<.01**

In the area of mathematics, the average growth of SWD in ICT classes was compared to the average growth of SNI in ICT classes. Out of fifteen comparisons, twelve found no significant difference between the two groups. In two comparisons the null hypothesis was rejected as the students with disabilities grew significantly more than the students not identified: one yearly fourth grade comparison ($M1 = 63.34$, $M2 = 49.54$, $t = 2.01$, $df = 49$, $p = .05$), and one fifth grade comparison ($M1 = 56.07$, $M2 = 42.57$, $t = 2.01$, $df = 69$, $p = .049$). In one sixth grade comparison the students not identified did significantly better than the students with disabilities ($M1 = 59.66$, $M2 = 76.26$, $t = 2.77$, $df = 68$, $p = .007$). (see table 4.10) Therefore, 80% (12/15) of the comparisons found no difference between the growth of the students with disabilities in the integrated co-taught classes compared to the growth of students not identified in mathematics. 13% (2/15) of the comparisons resulted in greater academic growth for students with disabilities in integrated co-taught classrooms, and 7 % (1/15) of the comparisons resulted in greater academic growth for students not identified compared to students with disabilities within integrated co-taught classrooms.

Summary

The purpose of this study was to examine the impact of participation in integrated co-taught classrooms on the academic growth of students with disabilities and students not identified as having educational disabilities in the areas of English Language Arts and mathematics compared to participation in traditional classrooms. Overall, when including all students, it was found that in most comparisons participation in an ICT classroom did not significantly impact either positively or negatively the average academic growth in English

language arts (12/15). In mathematics students' growth was comparable (8/15) or better in ICT (5/15).

Table 4.11

Summary

	No Difference		ICT Better		Traditional Better	
	Number	Percentage	Number	Percentage	Number	Percentage
All Students ELA	12	80	2	13	1	7
All Students Math	8	53	5	33	2	13
SNI ELA	12	80	2	13	1	7
SNI Math	10	67	4	27	1	7
SWD ELA	12	80	1	7	2	13
SWD Math	14	93	0	0	1	7
Total	68	75	14	16	8	8

When comparing the academic growth of only students not identified as having a disability between the ICT and traditional classrooms the findings were similar. In most of the comparisons, the academic growth in English language arts (12/15) and mathematics (10/15) was not significantly better or worse between the two settings. If there was a significant difference, it was more likely that the students SNI grew more academically in the ICT setting. This positive effect was evident to a greater degree in math (4/15) than in English language arts (2/15).

In comparing the academic growth of students with disabilities between the ICT and traditional classroom setting, it was found that for most of the comparisons there was no significant difference in academic growth between two settings for English language arts (12/15)

or mathematics (14/15). If there was a difference, it was slightly more likely for the significant growth to be in the traditional environment than the ICT setting for English language arts. For math in all but one of the comparisons, there was no significant difference in academic growth between the ICT and traditional classroom setting. Only one comparison resulted in greater growth in the traditional classroom setting. An important caveat here is that students in traditional classrooms received less special education support throughout the day and, therefore, would be expected to be impacted to a lesser extent by their disability status.

Finally, when exploring the impact of the ICT classroom on students with disabilities compared to their classmates who have not been identified as having an educational disability, it was found that in most comparisons there was not a significant difference between the two groups. However, in English language arts five comparisons found a significantly positive impact on SWD when compared to their nondisabled peers and only one comparison found a positive effect on English language arts on the students not identified. In mathematics, two comparisons suggested more significant growth for SWD and one comparison indicated greater growth for SNI. Overall, the ICT classroom did not result in significant differences in growth between the two groups, but in comparisons that were significant, it was more likely to have positively impacted students with disabilities.

Chapter 5

Discussion

In this section, the key findings of this study will be summarized and then analyzed for implications for policies and practices regarding integrated co-teaching and its impact on academic achievement in English language arts and mathematics for students with and without disabilities. The strengths and limitations of this study are discussed in terms of research design and data analysis including issues related to the reliability and validity of the study. Next, areas of future research are followed by critical conclusions from this study.

Key Findings

This study examined eight research questions related to the impact of co-teaching on the academic growth of students in grades four through six in English language arts and mathematics. These issues were also addressed in relation to disability status. The overarching question of this study was how participation in integrated co-taught classrooms, as defined by New York State regulations and implemented in this district (one gereral education teacher, one special education teacher and a certified teaching assistant for the full day), impacts the academic growth of students with and without disabilities compared to participation in a traditional classrooms. This study examined whether the comparative achievement growth for students in integrated co-taught classes was commensurate, positive or negative when compared to the academic growth for students in traditional classrooms. Finally, this study addressed whether there were differences in the impact of participation in an integrated co-taught class on academic growth for students with disabilities compared to non-identified peers within the co-taught setting in English language arts and math.

One hypothesis for this study based, on prior research, was that students with disabilities would benefit academically from participation in a co-taught setting (Curcic, 2012; Garderen, Stormont, & Goel, 2012; Hang & Rabren, 2009; Solis, Vaughn, Swanson, & McCulley, 2012; Walsh, 2012). A second hypothesis was that participation in a co-taught setting would not negatively impact the achievement of students not identified as having a disability in an integrated environment (Dessemontet & Bless, 2013; Ghandi, 2007; Kalambuka, Farrell, Dyson & Kaplan, 2007; McDonnell, Thiorson, Disher, Mathot-Buckner, Mendel, & Ray, 2003; McDonnell et al., 2003; Ruijs, 2017; Szumski, Smorgorzewski, & Karwowski, 2017). From the literature, it was expected that co-taught classrooms would benefit students with disabilities more than students not identified as having disabilities. However, there are no relative growth comparisons found in the literature. Because growth assessments are a relatively new concept in the field of education (Amrein-Beardsley, 2014), there is little research comparing differences in growth between English Language arts and math in the co-taught setting.

Each research question was assessed by looking for statistical differences between each setting by grade for a series of five years. There were 15 comparisons per question. The number of comparisons resulting in no significant differences as well as the number and direction of significant differences was analyzed. The results in terms of percent of the comparisons allows for predictions in terms of the likelihood of that outcome.

This first research question addressed was as follows: Is there a significant difference between the academic growth for all students in the integrated co-taught classroom compared to all students in traditional classrooms in English language arts? The results of this study found that the academic growth of all students in grades four through sixth grade in ICT classrooms is generally comparable to the growth of students in traditional classes in English language arts

(12/15). While most of the comparisons showed that students in integrated co-taught classrooms grew at a similar rate as their peers in traditional classrooms, in two comparisons they grew more, and in one comparison the students in traditional classrooms showed more significant growth. Overall, participation in an ICT classroom resulted in comparable or better growth than participation in a traditional classroom in 93% of the comparisons for all students in English language arts.

The next research question addressed was: Is there a difference between the academic growth for all students in the integrated co-taught classrooms compared to all students in traditional classrooms for mathematics? The results suggest that the academic growth of all students in grades four through sixth grade for mathematics in ICT classrooms is comparable to the growth of students in traditional classrooms (8/15) or better (5/15). Two comparisons resulted in better growth in the traditional classroom setting. Therefore, students in ICT grew as much or better than students in traditional classrooms in 88% of the comparisons. In one third of the comparisons students did better in the ICT setting suggesting that its may offer some benefit to math achievement.

Research question three addressed whether there was a difference in the academic growth for only students not identified as having a disability (SNI) who attended integrated co-taught classrooms compared to SNI who participated in traditional classrooms in English language arts? Most comparisons resulted in comparable growth between the two settings 12/15. Two comparisons suggested more significant growth in the ICT setting and only one resulted in more significant growth in the traditional classroom setting. Therefore, in 93% of the comparisons, SNI did as well or better than their peers in conventional classroom settings.

Research question four addressed whether there is a difference in the academic growth for students not identified as having a disability (SNI) who attended integrated co-taught classrooms compared to traditional classrooms in mathematics? Most comparisons resulted in comparable growth between the two settings (10/15). Four comparisons suggested more significant growth in the ICT setting and only one resulted in more significant growth in the traditional classroom setting. Therefore, in 93% of the comparisons, SNI did as well or better than their peers in traditional classroom settings in mathematics.

The next question explored if there was a difference in the academic growth in English language arts for students with a disability (SWD) compared to SWD who attended traditional classrooms? The results suggest that in English language arts, SWD grew comparably (12/15) in both the ICT setting and in the traditional classroom with push in or pull out special education support. In two comparisons SWD grew more in the traditional environment. An important consideration for this comparison is that students in the traditional classroom setting would likely be less academically impacted by their educational disability as the Committee on Special Education did not determine that they required full day support. The level of impact is likely a confounding factor in this comparison, and these results should be reviewed by the reader cautiously. Overall, in 87% of the comparisons SWD did as well or better in ICT classes as in traditional classrooms.

Next, I explored the question of if there was a difference in the academic growth in mathematics for students with a disability compared to students with a disability who attended traditional classrooms. The results suggest that in mathematics, SWD grow comparably (14/15) in both the ICT setting and in the traditional classroom with push in or pull out special education support. In only one comparison did SWD grow more academically in the traditional setting.

Again, an important consideration for this comparison is that students in the traditional environment would likely be less academically impacted by their educational disability. The Committee on Special Education did not determine that they require full day support, and the level of impact is likely a confounding factor in this comparison. These results should be reviewed cautiously by the reader.

The last area to be explored was the impact of participation in ICT on SWD versus SNI. Is there a difference in the academic growth in English language arts for students with a disability compared to students not identified within an integrated co-taught classroom in English language arts? The results suggest that ICT affected growth for both groups equally in ELA (10/15) for 66% of the comparisons, and SWD were affected positively (4/15) 27% of the time. In only one comparison did SNI grow more than SWD in English language arts.

Next, the same question was addressed in mathematics. Is there a difference in the academic growth in mathematics for students with a disability compared to students not identified within an integrated co-taught classroom in English language arts? In 80% of the comparisons, the students grew equally (12/15). Two comparisons showed more significant growth for SWD, and again, only one showed better growth for SNI in mathematics.

Overall, these results suggest that participation in an integrated co-taught classrooms is unlikely to negatively impact the academic growth of students with and without disabilities in either English language arts or mathematics. If there was a difference in the academic growth for students it was more likely that ICT positively impacted growth than the traditional setting. This was even more likely in mathematics. Finally, students with disabilities may benefit slightly more in English language arts than their non-identified peers from participation. However, both groups appear to grow comparably within the ICT setting.

Implications for policies and practices

The above findings have many implications for policy makers and educational administration. First and foremost, they suggest that student participation in integrated co-taught classes is unlikely to negatively impact the academic growth in English language arts or math for either students with disabilities or their non-identified peers when compared to participation in traditional classes. There may be a benefit for all students particularly in the area of mathematics. One can conclude that participation in the co-taught setting is unlikely to negatively impact academic growth for students not identified in either reading or math compared to the traditional classroom. Therefore educational leaders should feel confident that expanding this model is unlikely to negatively impact academic achievement. However, these findings also suggest that the integrated co-taught model presented in this study, as defined by staffing, is not a definitive factor in growth as there were exceptions in every group comparison. There are undoubtedly other factors (school, classroom, teacher) that impact overall achievement.

Policymakers should continue to look for ways to evaluate educational programs based on growth. Student growth percentiles at an aggregate level may be an effective way to assess impact. Decisions regarding educational programming should be made that anticipate positive outcomes. Integrated co-teaching is an instructional model that allows students with disabilities direct access to grade level curriculum and the social–emotional benefits of meaningful participation in the general education setting with their peers. The additional staff and collaboration can allow for accommodations and modifications of curriculum that can meet the needs of all learners. While co-teaching is an inclusive special education model that can address the needs of students with a disability, this study should encourage educators to pursue co-teaching as a methodology that can effectively meet the instructional needs of all students

regardless of their disability status. This study provides evidence that co-teaching is a special education model that educational leaders can feel confident will not negatively impact student achievement and, therefore, can be expanded as a model that can address the abilities and strengths of all learners in an inclusive setting while exploring best practices to optimize student outcomes.

Strengths and limitations of the study

The strengths of this study include the relatively large sample size and the availability of data over five years. There was also a great deal of consistency in the staffing arrangements and average class size included in the sample. Comparing academic growth rather than proficiency allowed for tracking student growth rather than cohort proficiency and provides a different type of analysis that includes information regarding how co-teaching affects academic progress rather than proficiency. The New York State Testing program data allowed for robust data that is comparative across the state.

Limitations

Potential problems with this study include confounding effects from a variety of areas including instructional quality and curriculum. There is a great deal of variation in the methods of instruction used in the integrated co-taught classrooms and in teacher quality. These factors vary across classes and could contribute to a difference in growth. Student characteristics, such as the type of disability may mask or enhance differences that may not be due to the integrated co-taught classroom. The number of teaching assistants in the room could also confound the results.

Other limiting factors are that data was aggregated at grade level rather than classroom level, and classroom factors likely contribute to differences. There is no baseline for what would

be expected growth as student growth percentiles compare student to student and not to adequate progress. Students in special education must close the gap so merely keeping up with other students does not necessarily imply sufficient growth.

This study was comparative in nature and not causal. One will not be able to attribute differences between groups directly to the type of classroom in which the students participated. Further, it did not include students with severe disabilities who participated in the New York State alternate assessment process.

The validity of the construct of the co-taught classroom applies only to the staffing level described in this study (one general education teacher, one special education teacher, one teaching assistant for a full day). The validity of academic growth relies on the operational definition of achievement determined by the New York State testing program. These assessments are assumed to be adequate representations of grade-level knowledge.

The relatively large sample size and normality of the sample size increase the validity of the study. Completing the statistical analysis by grade level rather than building or district increased the chance for reliability issues and the impact of the error of measurement of the student growth percentile as it decreases the power of the analysis. The large sample size used in this study should control for variability. However, because the sample is from only one district, this will limit generalizability. The identification and placement of students with a disability are somewhat subjective and is not random. The methods of instruction in integrated co-taught classrooms and push-in and pull-out services are not identified or consistent.

The reliability and validity of student growth percentiles could be a factor and should be considered by the reader when interpreting results. There are concerns raised regarding the reliability of student growth percentiles using both quartile and linear regression (Lash,

Makkonen, Tran, & Huang, 2016; McCaffery, Castellano, & Lockwood, 2015; Lockwood & Castellano, 2015; Monroe, 2015; Monroe and Cali, 2015; Sireci, 2017). Lash et al. (2016) caution against using student growth percentiles in high stakes decisions. They investigated the stability of teacher-level student growth percentiles over time and found that even when computed as an average of annual teacher-level growth scores over three years, estimates of teacher effectiveness do not meet the level of stability that some argue are needed for high-stakes decisions about individuals (Lash et al., 2016). However, using mean growth percentiles have greater reliability (Monrie, 2015). Monroe and Cali (2015) indicate that aggregate estimates (means) used by most states may have higher reliability, but caution that due to the policy questions surrounding student growth percentiles they require further attention by psychometricians and policy experts.

Mean student growth percentiles are a popular measure of educator evaluation, however, mean growth percentiles lack rigorous evaluation (Castellano, Mccaffrey, & Service, 2017). Errors of MGP are correlated with average prior latent achievement and underestimate true teacher performance for those with low prior achieving students and overestimate for teachers with high prior achieving students affecting the validity of the measure. Castellano et al. (2017) found a spurious relationship between Mean Growth Percentiles (MGPs) and students average prior achievement they conclude is problematic for the use of MGPs as a performance indicator for educator evaluation and accountability.

There have also been validity concerns raised regarding student growth percentiles. Guarino, Reckase, Stacy and Wooldridge (2015) found that non-random grouping and assignments can negatively affect student growth percentile approaches. The relative performance of student growth percentiles depends on how students are grouped and assigned to

teachers. They found that student growth percentiles performed worse than value-added measures that control for prior year student test scores and include teacher fixed effects when the assignment of students to teachers is nonrandom.

Concerns exist regarding how student growth percentiles are interpreted and used. Firstly, student growth percentiles do not imply causality and cannot be used to determine what or who was responsible for the growth (Betebenner, 2009). Betebenner (2011) states that the current climate of high-stakes, test-based accountability has blurred the lines between program evaluation and accountability. He goes on to assert that the emphasis of value-added models toward causal claims regarding school and teacher effects has skewed discussions about growth models toward causal claims at the expense of description (Betebenner, 2011).

In spite of the reliability and validity concerns regarding student growth percentiles, in this study, they were used comparatively and descriptively and interpreted cautiously given known concerns regarding reliability and validity. Student growth percentiles were used in this study to explore differences and not for high stakes decisions such as teacher evaluation. Because this study used group means, they may be used confidently to determine program effectiveness (Choi, 2018; Kelberlau, 2015) and used for comparative purposes. The large sample size and use of mean growth percentiles increases confidence in the results.

Areas of future research

There are many challenges in studying co-teaching. Weichel and Murawski (2001) described six limitations in research on co-teaching including leaving out vital information on measures employed, interviewing co-teachers already considered successful, different definitions of co-teaching, qualitative rather than quantitative studies; and few studies that include the actions of the special education teacher during the process of co-teaching and these factors

should be considered in future research. It is suggested that the effectiveness of co-teaching be explored through carefully designed experimental studies (Volino & Zigmond, 2007). Salend and Duhaney (1999) conclude that researchers and school districts need to work together to validate and disseminate information regarding effective inclusions practices, policies, and programs.

Future research should include mixed methods studies of co-teaching that include qualitative and quantitative analysis at the classroom, school and district level. Ghandi (2007) concludes that quantitative research methods are insufficient for truly understanding the effects and dynamics of inclusion and suggests future mixed methods studies that examine how integration impacts effects and how contextual characteristics may mediate effects. This type of research would allow for determining what factors contribute to the most significant outcomes within a co-taught in the areas of curriculum, instruction and teaching methodology. Student level factors such as grade level and type of disability and teacher level factors such as level of training and classroom management practices should also be taken into consideration to allow for predictions regarding impact on this instructional model. Areas of interest for future studies might include how co-teaching impacts English language arts and math and why this may be so, and if co-teaching impacts students with and without disabilities differently. Additionally, student growth percentiles hold promise as an effective descriptive and comparative way to assess student achievement in future studies.

Conclusions

The findings from this study suggest that, consistent with previous research, co-teaching may be a promising inclusive educational environment for promoting student achievement for students with disabilities (Curcic, 2012; Garderen, Stormont, & Goel, 2012; Hang & Rabren,

2009; Solis, Vaughn, Swanson, & McCulley, 2012; Walsh, 2012). Participation in a co-taught classroom is unlikely to negatively impact academic achievement in English language arts or mathematics and is more likely to result in positive growth than the traditional classroom setting. Further, it is unlikely to impact students without disabilities negatively (Dessemontet & Bless, 2013; Ghandi, 2007; Kalambuka, Farrell, Dyson & Kaplan, 2007; McDonnell, Thiorson, Disher, Mathot-Buckner, Mendel, & Ray, 2003; McDonnell et al., 2003; Ruijs, 2017; Szumski, Smorgorzewski, & Karwowski, 2017). Additional findings suggest that participation in a co-taught classroom was more likely to positively affect mathematics than English language arts and that students with disabilities may benefit from slightly more from a co-taught setting than their peers who have not been identified.

As co-teaching continues to grow as an instructional model that meets the needs of all learners, this study provides evidence that educators can be assured that it will not have a negative impact on student achievement. As found by Ruijs (2017) the presence of students with special needs does not have a significant effect on the academic achievement of their classmates. This study confirms the findings of Szumski, Smogorzeski and Kawowski (2017) that the inclusion of students with disabilities in the classroom may have an slightly positive effect on students who have not been identified as having an educational disability. They also identified a number of moderators that may affect achievement including the manner of implementation, educational team composition, the level and type of disorder of the students with disabilites, and the educational stage of the students. This study adds content area as a future area for exploration. There are clearly factors beyond staffing that effect the achievement outcome for students. Further research should examine these factors so that best practices can be implemented in the co-taught classroom.

The findings from this study validate co-teaching as an instructional model that can effectively impact students' academic growth in Enlish language arts and mathematics at least to the same level as traditional classrooms. Educational leaders concerned with social justice can confidently support the integration of students with disabilites in the general education setting and be assured that inclusion is not at the expense of academic achievement. Additionally, this study confirms that there are factors beyond staffing that impact achievement in the classroom. Strogilo, Tragoulia, and Kaila (2015) found evidence that the benefits of supportive co-teaching are hindered by traditional teaching roles, undifferentiated teaching material and poorly modified instructional practices.

Researchers should continue to investigate co-teaching to determine best practices that can be supported by data and drive future decisions. As concluded by Van Garderen, Stormont and Goel (2012) it is important that future research promotes systems that set specific goals for collaboration, monitor collaborative practices through direct observation, implement integrity checklists to overcome barriers, and monitor progress with data on student outcomes.

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Employment

Executive Director of Special Education 8/11-present
Liverpool Central School District: 195 Blackberry Lane, Liverpool, N.Y. 13090

- Developed, implemented and administered district-wide special education services
- Supervised and supported special education teachers, teaching assistants, school psychologists, occupational and physical therapists and speech therapists
- Responsible for developing and monitoring program budgets and federal grants
- Collaborated with local, regional, state and federal organizations to support special education programming
- Assisted with professional development to implement effective research-based practices and support district goals
- Completed all special education state reporting and data analysis

Director of Special Programs 8/06-8/11
Oswego City School District: 120 E. 1st St. Oswego, N.Y. 13126

- Developed, implemented and administered district-wide special education services
- Supervised and supported special education teachers, teaching assistants, school psychologists, school social workers, school counselors and speech therapists
- Chaired the Committee on Preschool Special Education
- Responsible for developing and monitoring program budgets and federal grants
- Implemented Response to Intervention and School-Based Intervention Teams
- Collaborated with local, regional, state and federal organizations to support special education programming
- Served on at-risk committee to increase student achievement and graduation rates

- Assisted with professional development to implement effective research-based practices and support district goals
- Completed all special education state reporting and data analysis

Assistant Director of Special Programs 7/02-7/06
Oswego City School District: 120 E. 1st St. Oswego, N.Y. 13126

- Chaired Committee on Special Education and Committee on Preschool Special Education
- Served as school psychologist and speech therapist team leader
- Served on Standards-Based Report Card Committee
- Served on Reading First Implementation Committee
- Served on Committee for Implementation of Universal Pre-Kindergarten

Administrative Intern 9/01-6/02
Oswego City School District: 120 E. 1st St. Oswego, N.Y. 13126

- Chaired Committee on Special Education and Committee on Preschool Special Education

School Psychologist 9/96-8/01
Oswego City School District, Fitzhugh Park Elementary School: Oswego, N.Y. 13126

- Chaired Pupil Service Team
- Provided psychological assessment and services to K-6 students

Psychological Assistant 8/95-8/96
Benjamin Rush Center: Syracuse, N.Y. 13224

- Assisted Dr. Norman J. Lesswing with psychological evaluations
- Administered psychological tests to psychiatric inpatients and private practice clients

School Psychologist 9/93-8/96
Part-time at Oswego County BOCES: Mexico, N.Y. 13114

- Provided preschool evaluations and counseling

School Psychologist 9/90-6/94
Part-time at Sandy Creek Central School District: Sandy Creek, N.Y. 13126

- Provided psychological services K-12

Certification

New York State School Administrator and Supervisor / School District Administrator

New York State Permanent Certification as a School Psychologist